03.04-08/01/94-00676

SITE 16: WEST ROAD LANDFILL CLEARANCE SAMPLING AND POLYCHLORINATED BIPHENYL (PCB) SCREENING REPORT FOR NAVAL WEAPONS STATION (NWS) YORKTOWN, VIRGINIA

Prepared By

BLACK & VEATCH Waste Science, Inc.

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Table of Contents

BLACK & VEATCH Waste Science, Inc.
Site 16 Clearance Sampling and
Polychlorinated Biphenyl (PCB) Screening Report

1.0 Introduction

BLACK & VEATCH Waste Science Inc. (Black & Veatch) was tasked by the Environmental Protection Agency Region III (EPA) to perform oversight activities at Site 16, West Road Landfill, located on the Naval Weapons Station, Yorktown, Virginia National Priority List Site. The site had been designated for a limited non-time critical removal action for surface debris, including scrap metal, bomb casings, and batteries. Oversight performed by Black & Veatch on May 31, 1994, included collecting split samples from International Technology, Inc. (IT), the Navy's contractor, and performing screening for PCB's at other locations within Site 16. The purpose of the sampling event was to confirm clearance data obtained by the Navy's Contractor and to identify any secondary source areas where PCB contamination may be responsible for residual concentrations which were measured in sediments and soils by previous studies.

2.0 Background

Site 16 covers approximately 9 acres and is located adjacent to West Road near Indian Field Road (Figure 1). Drainage from the site flows into a branch of an intermittent stream which is fed by Lee Pond. The intermittent stream flows northeast from Lee Pond and passes along the south boundary of Site 16, eventually flowing west into the east branch of Felgates Creek. The drainage ditch from Site 16 appears to originate at the base of the fill area on the northeast portion of the site where it flows south for about 450 feet and connects into the intermittent stream from Lee Pond.

Site 16 was operated from the early 1950s to the early 1960s. Wastes reported as disposed include dry carbon-zinc (Leclanche) batteries, banding materials, hydraulic fluid, unknown types of chemicals, and 55-gallon drums (contents unknown). Investigations at this site confirmed the presence of drums, scrap metal, batteries, mine casings, and construction debris. Another waste area was also identified beneath one of the drum piles. This waste area consisted of glass containers, cans, and newspapers. Landfill boundaries are not evident from visual observation of the area. The site is currently wooded, except for the northern portion along West Road, which is covered with grasses.

Site 16 was studied under the Round One and Two Confirmation Studies completed by Dames and Moore and the Round One Remedial Investigation Study (Round One RI) completed by Weston, Inc. The summarized analytical data and sampling locations for these studies is included in Appendix A.

No soil (source) samples were collected during the Round One and Two Confirmation Studies; however, a groundwater sample collected from the fringe of Site 16 contained total

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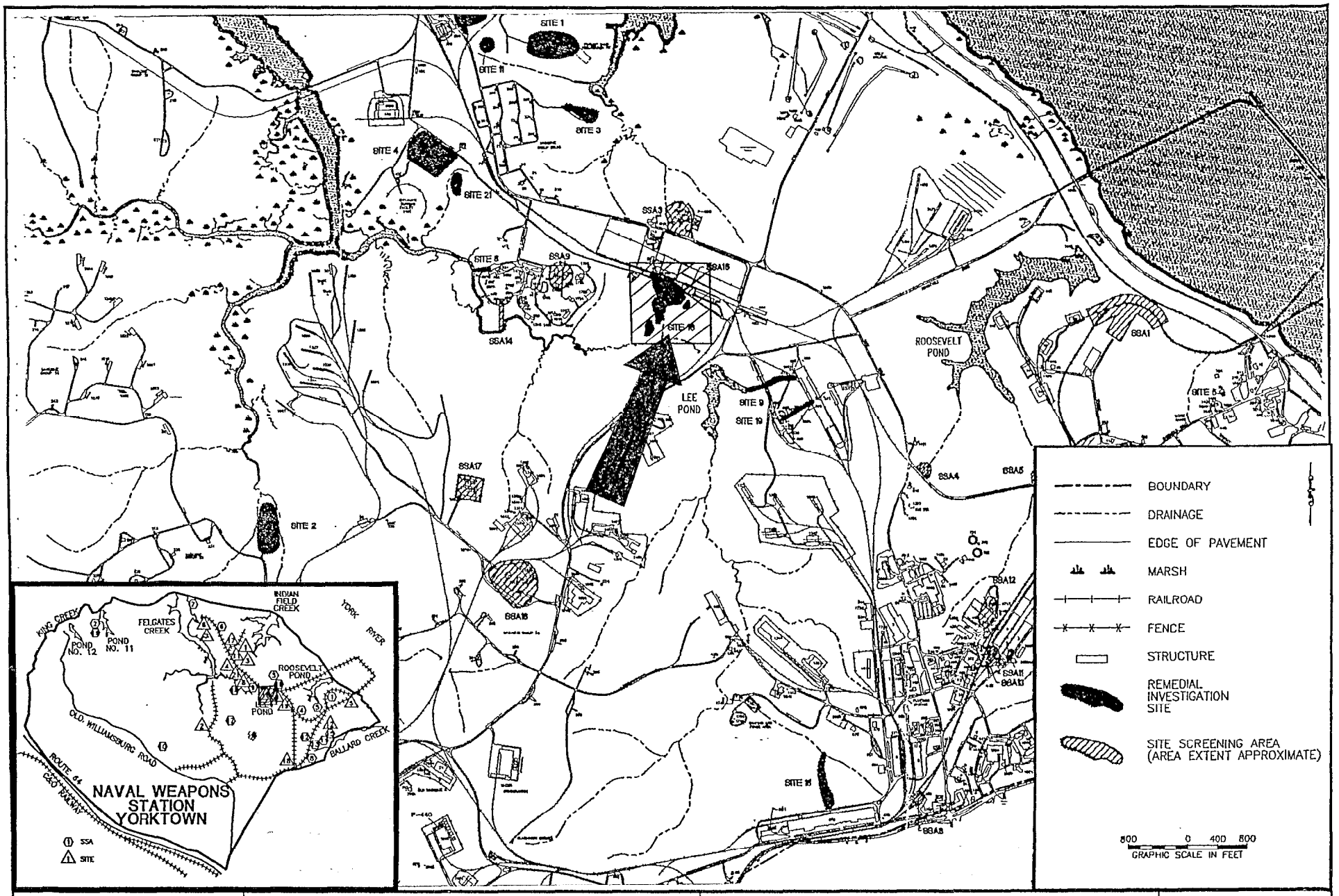

BLACK & VEATCH
Waste Science, Inc.

Naval Weapons Station, Yorktown

Site 16: LOCATION

FIGURE 1

phenol concentrations in excess of Virginia Groundwater Standards. Additionally, zinc concentrations exceeded groundwater standards, and heptachlor was detected at a concentration exceeding the Virginia Groundwater Standards in a potentially upgradient well. It was not certain whether these detections were attributable to Site 16.

The Round One RI soil data showed no high (>1 mg/kg) concentrations of contaminants, indicative of "hot spots". Most detections of organics occurred in surface soils, with the majority being Base/Neutral/Acid extractable organics (BNAs). While the detections were not high, they also included pesticides (<10 ug/kg) and PCBs (<1 mg/kg) in addition to the BNAs. Metals concentrations were reported to be typical of background conditions. The site surface soils and sediments in the drainage ditch contained low levels of BNA organics (<1 mg/kg) and PCBs (<100 mg/kg). An upstream sediment sample contained BNA compounds at comparable or higher concentrations. There were no contaminants detected at the two surface water samples nearest the landfill. The sample at the location most remote from the landfill did show low levels of volatile contamination (<10 ug/L), phenol, and 850 ug/kg of methylphenol. Methylphenol was not detected in any surface soil sample, but was present in two sediment samples collected from the ditches closest to the landfill.

In September 1992, Naval Weapons Station, Yorktown partially removed scrap metal from the surface along the northeastern section of Site 16. The area was also backfilled with soil and revegetated. The removal was conducted by the Weapons Station after the Round One Remedial Investigation Study completed by Weston, Inc.

Removal of surface debris by IT was completed during May, 1994. Surface debris removal was concentrated on the south side of Site 16. Scrap metal, mine casings, batteries, and drums were removed from several locations. The mine casings were reported to have been inert.

3.0 Procedure

On May 31, 1994, Black & Veatch collected 6 surface soil samples from Site 16 for contract laboratory program (CLP) analysis of Target Compound List (TCL) organics and Target Analyte List (TAL) metals. Additionally, 11 soil screening samples were collected for analysis with the Millipore Enviroguard™ PCB Immunoassay soil kit. Two of the samples which were screened using the Immunoassay kit were also analyzed through CLP, representing about a 20% confirmation ratio between the screening samples and the lab samples. All samples were homogenized to ensure representative splits.

The Enviroguard™ PCB soil analysis kit included several procedures which are outlined as follows:

1. Extract 5 grams of soil with 5 ml of methanol.

2. Filter the methanol extract.

3. Perform Immunoassay test with antibody coated test tubes and appropriate solutions.

4. Measure and record absorbance (at 450 nanometers) of standards and extracts against the blank solution.

5. Perform regression analysis of PCB standards and comparison with sample data.

Specific procedures involved in the screening analysis as described by Millipore are included in Appendix B.

The approximate sampling locations are shown on Figure 2. Appendix D shows the sampling locations on IT's proposed removal action construction drawings. Sampling was conducted near the location of previous IT clearance samples. Additionally, the origin of the drainage ditch and several locations extending approximately 75 feet from the beginning of the drainage ditch were screened for PCBs. These drainage ditch locations were not part of the IT removal action area, and may represent downgradient receptor pathways from potential source areas remaining in Site 16.

4.0 Findings

The contaminants detected in the soil samples analyzed through CLP are shown in Table 1. Appendix C contains the validated data for each sample which was analyzed as part of the Site 16 sampling episode. For the soil samples, volatile organics, semi-volatile organics, and metals were present at all sampling locations. Pesticide/PCBs were detected in three of the five samples.

In order to evaluate the data, the measured concentrations were compared to the residential soil risk-based screening value found in the Risk-based Concentration Table, Third Quarter 1994, which provides a concentration above which additional toxicological information may be necessary for decision-making purposes (Smith, 1994).

None of the measured volatile organics exceeded the risk-based soil screening value for residential soil. The risk-based screening value for benzo(a)pyrene in residential soil (88 mg/kg) was exceeded in soil sample EPA-SS-16-05 (100J ug/kg).

The risk-based screening value for dieldrin (40 ug/kg) in residential soil was exceeded in EPA-SS-16-02 (58J ug/kg) and EPA-SS-16-05 (41 ug/kg). Additionally, the risk-based screening value for PCBs (83 ug/kg) in residential soil was exceeded in EPA-SS-16-05 (1,400 ug/kg aroclor 1254 and 3,000 ug/kg aroclor 1260).

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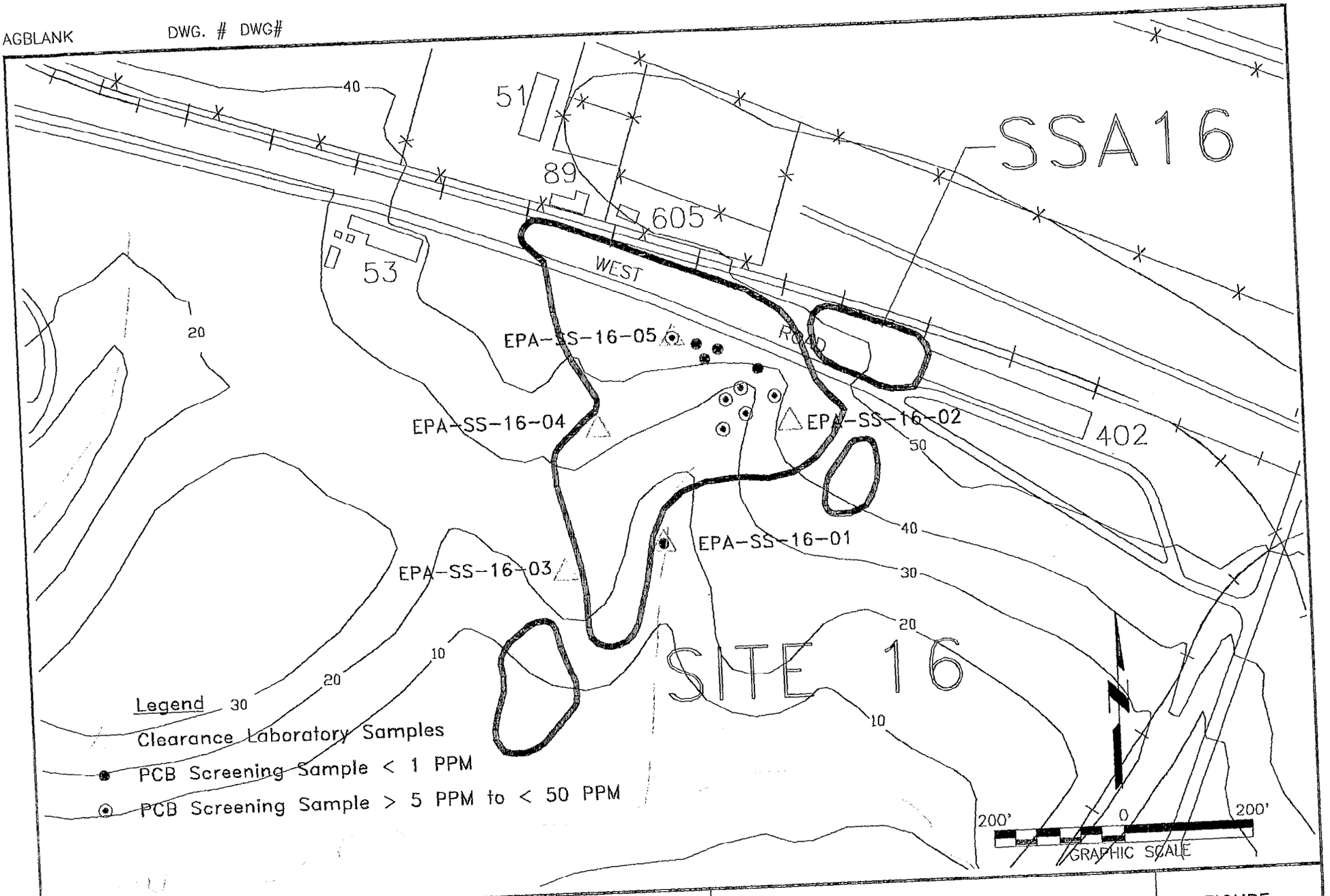


BLACK & VEATCH Waste Science, Inc.	Naval Weapons Station, Yorktown	Site 16: Clearance Sampling and PCB Screening Locations	FIGURE 2

Table 1 Site 16 Sampling, Data Summary Table May 31, 1994 Sampling Event

Analyte	Risk-based* Screening Value (ug/kg)	EPA-SS-16-01 (ug/kg)	EPA-SS-16-02 (ug/kg)	EPA-SS-16-03 (ug/kg)	EPA-SS-16-04 (ug/kg)	EPA-SS-16-05 (ug/kg)	TB-16-01 (ug/l)
Volatile Organics							
1,1,2,2-Tetrachloroethane	3,200	--	--	0.9J	--	--	--
1,2,3-Trichloropropane	91	--	--	1J	--	--	--
1,2-Dichloroethane	7,000	--	--	--	--	--	2J
2-Butanone	47,000,000	--	--	--	--	--	5J
Acetone	7,800,000	6B	7B	--	4B	--	15B
Methylene Chloride	85,000	3B	--	--	--	4B	0.6B
Napthalene	3,100,000	--	--	2J	--	--	--
Semi-volatile Organics							
Benzo(a)anthracene	880	--	--	--	--	100J	NA
Benzo(a)pyrene	88	--	--	--	--	100J	NA
Benzo(B)fluoranthene	880	--	--	--	--	100J	NA
Benzo(g,h,i)perylene	--	--	--	--	--	80J	NA
Benzo(k)fluoranthene	8,800	--	--	--	--	100J	NA
Benzoic Acid	310,000,000	--	--	300J	--	--	NA
Bis(2-ethylhexyl)phthalate	46,000	--	50J	70J	40J	100J	NA
Chrysene	88,000	--	--	--	--	100J	NA
Di-n-octylphthalate	1,600,000	--	--	--	70J	--	NA
Fluoranthene	3,100,000	--	--	--	--	200J	NA
Indeno(1,2,3-cd)pyrene	880	--	--	--	--	70J	NA
Phenanthrene	--	--	--	--	--	100J	NA
Phenol	47,000,000	60J	--	--	--	--	NA
Pyrene	2,300,000	--	--	--	--	300J	NA
Pesticide/PCB							
4,4'-DDD	2,700	--	3.4	140	--	35C	NA
4,4'-DDE	1,900	--	3.6	260	--	29C	NA
4,4'-DDT	1,900	--	11J	360J	--	71C	NA
Aldrin	38	--	3.7	--	--	--	NA
Alpha BHC	--	--	4.1	--	--	--	NA
Alpha Chlordane	490	--	--	--	--	39C	NA
Arochlor 1254	83	--	--	--	--	1400	NA
Arochlor 1260	83	--	--	--	--	3000	NA
Dieldrin	40	--	58J	--	--	41C	NA
Endosulfan-II	470,000	--	--	--	--	37C	NA

Table 1 Site 16 Sampling, Data Summary Table May 31, 1994 Sampling Event

Analyte	Risk-based* Screening Value (ug/kg)	EPA-SS-16-01 (ug/kg)	EPA-SS-16-02 (ug/kg)	EPA-SS-16-03 (ug/kg)	EPA-SS-16-04 (ug/kg)	EPA-SS-16-05 (ug/kg)	TB-16-01 (ug/l)
Endrin	23,000	--	--	--	--	90C	NA
Endrin Aldehyde	--	--	--	--	--	53C	NA
Endrin Ketone	--	--	5.4	--	--	--	NA
Metals							
Aluminum	--	10,800,000	3,890,000	7,350,000	10,700,000	7,380,000	NA
Antimony	31,000	--	--	600	--	1,700	NA
Arsenic	370	4,000	900	4,500	4,900	3,000	NA
Barium	5,500,000	31,800	47,500	85,000	28,800	67,900	NA
Beryllium	150	--	--	600	--	--	NA
Cadmium	39,000	--	--	2,100	--	30,600	NA
Calcium	--	675,000	17,100,000	1,950,000	214,000	1,450,000	NA
Chromium	390,000	17,600	5,800	31,600	22,700	72,900	NA
Cobalt	4,700,000	--	--	5,800	--	6,300	NA
Copper	2,900,000	3,000	257,000	29,900	5,200	352,000	NA
Iron	--	14,300,000	7,930,000	33,200,000	22,000,000	23,700,000	NA
Lead	500,000**	13,100	16,700	67,300	53,400	289,000	NA
Magnesium	--	503,000	334,000	886,000	875,000	680,000	NA
Manganese	390,000	29,200	110,000	484,000	50,200	284,000	NA
Mercury	23,000	--	--	100	--	1,500	NA
Nickel	1,600,000	--	4,400	13,600	4,600	19,500	NA
Potassium	--	653,000	300,000	780,000	1,120,000	404,000	NA
Selenium	390,000	400	--	--	--	--	NA
Vanadium	550,000	30,400	20,100	25,200	33,500	22,000	NA
Zinc	23,000,000	26,600	391,000	164,000	22,400	916,000	NA

* Risk-Based Concentration Table, Third Quarter 1994, EPA Region III, July 11, 1994
** Lead Health Advisory Level = 500,000
-- = not detected
NA = not analyzed
B = not detected above 10x the level reported in the laboratory or field blanks
C = See narrative for analyst observations (Appendix A)
J = Estimated Value
Shaded cells represent concentrations which exceed the risk-based screening concentration for residential soil.

The arsenic concentration in samples EPA-SS-16-01 (4,000 ug/kg), EPA-SS-16-02 (900 ug/kg), EPA-SS-16-03 (4,500 ug/kg), EPA-SS-16-04 (4,900 ug/kg), and EPA-SS-16-05 (3,000 ug/kg) exceeded the risk-based concentration for arsenic in residential soil (370 ug/kg). The risk-based concentration for beryllium (150 ug/kg) and manganese (390,000 ug/kg) were also exceeded in EPA-SS-16-03 (600 ug/kg beryllium and 484,000 ug/kg manganese).

The PCB data generated from the Immunoassay tests is shown in Table 2. PCBs were detected in 6 of the 11 screening samples which were analyzed using the PCB Immunoassay kit. Table 2 shows the results of this screening survey. The interpretation for soil screening samples EPA-SC-2 through EPA-SC-6 showed PCB contamination in the range of >5 to <50 ppm. Based on a calibration using aroclor 1248, it is expected that the concentrations of PCBs in these samples ranged from approximately 3.5 to 19 ppm of PCBs. Figures 3 and 4 show the PCB standard data and the regression analysis which was used to evaluate the screening data. The concentrations are "estimated" because the regression analysis was based on aroclor 1248 while the measured PCBs could have been other aroclor types.

Soil samples EPA-SS-16-05 and EPA-SS-16-01 were field screened for PCBs and analyzed by CLP procedures. The screening interpretation for EPA-SS-16-05 showed PCB contamination in the range of >10 to <50 ppm with a concentration based on aroclor 1248 of 13.45 ppm. Laboratory results indicated a concentration of 1.4 ppm of aroclor 1254 and 3.0 ppm of aroclor 1260, resulting in a total aroclor concentration of 4.4 ppm. The disparity in the laboratory results over the screening samples may be due to the difference in response of the Immunoassay test to arochlors 1254 and 1260 as opposed to aroclor 1248. The screening interpretation for EPA-SS-16-01 indicated that PCBs were below detection of the screening kit (< 1ppm, 0.5 ppm aroclor 1248). This result was confirmed by the laboratory results which indicated that PCBs were not detected above quantitation limits.

5.0 Conclusions

The following conclusions are based on the independent sampling data:

- None of the measured volatile organics exceeded the risk-based soil screening value for residential soil.

- The risk-based screening value for benzo(a)pyrene (88 mg/kg) was exceeded in soil sample EPA-SS-16-05 (100J ug/kg).

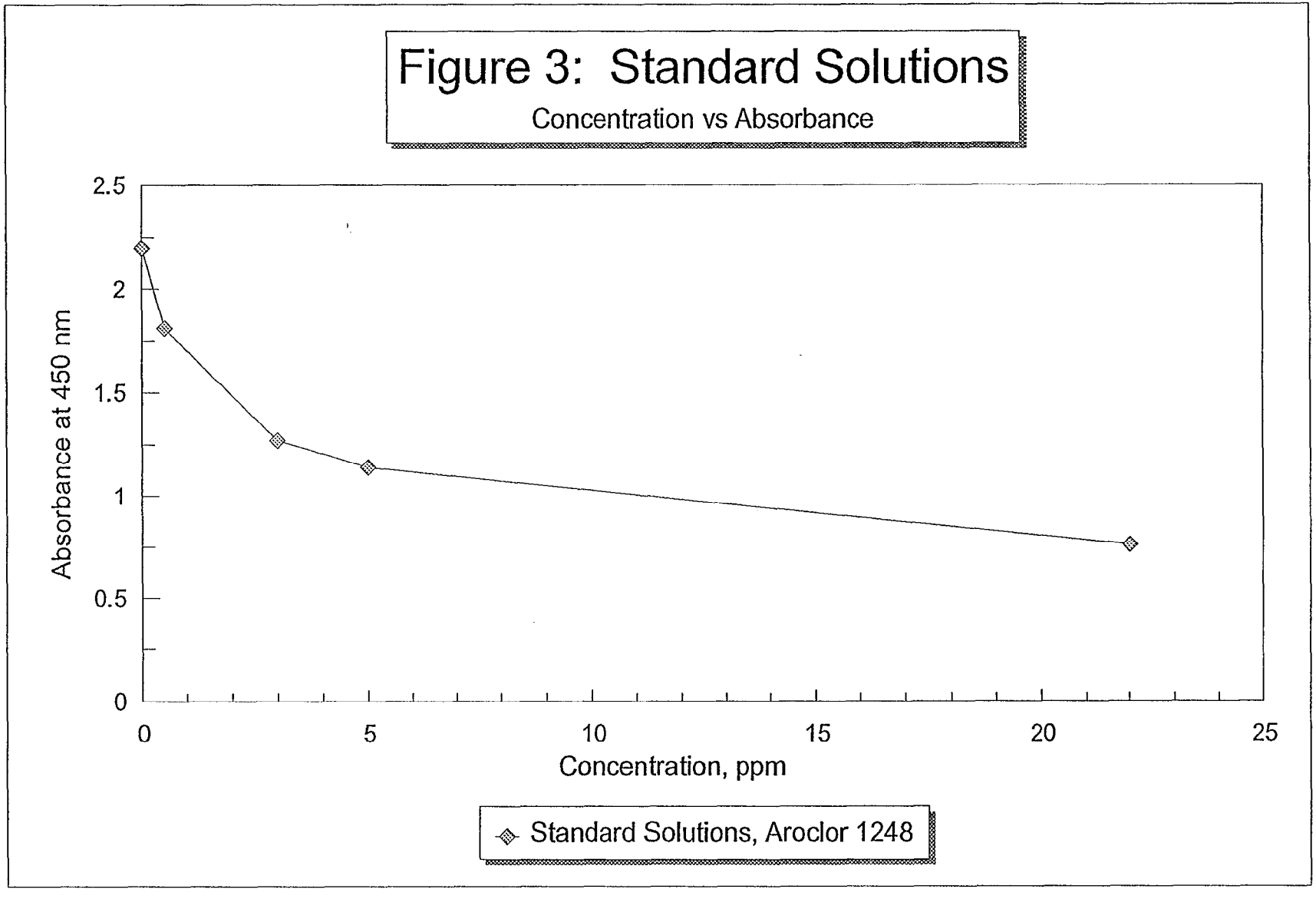
- The risk-based screening value for dieldrin (40 ug/kg) was exceeded in EPA-SS-16-02 (58J ug/kg) and EPA-SS-16-05 (41 ug/kg). Additionally, the risk-based screening value for PCBs (83 ug/kg) was exceeded in EPA-SS-16-05 (1,400 ug/kg aroclor 1254 and 3,000 ug/kg aroclor 1260).

Table 2
Naval Weapons Station, Yorktown
Site 16 PCB Screening

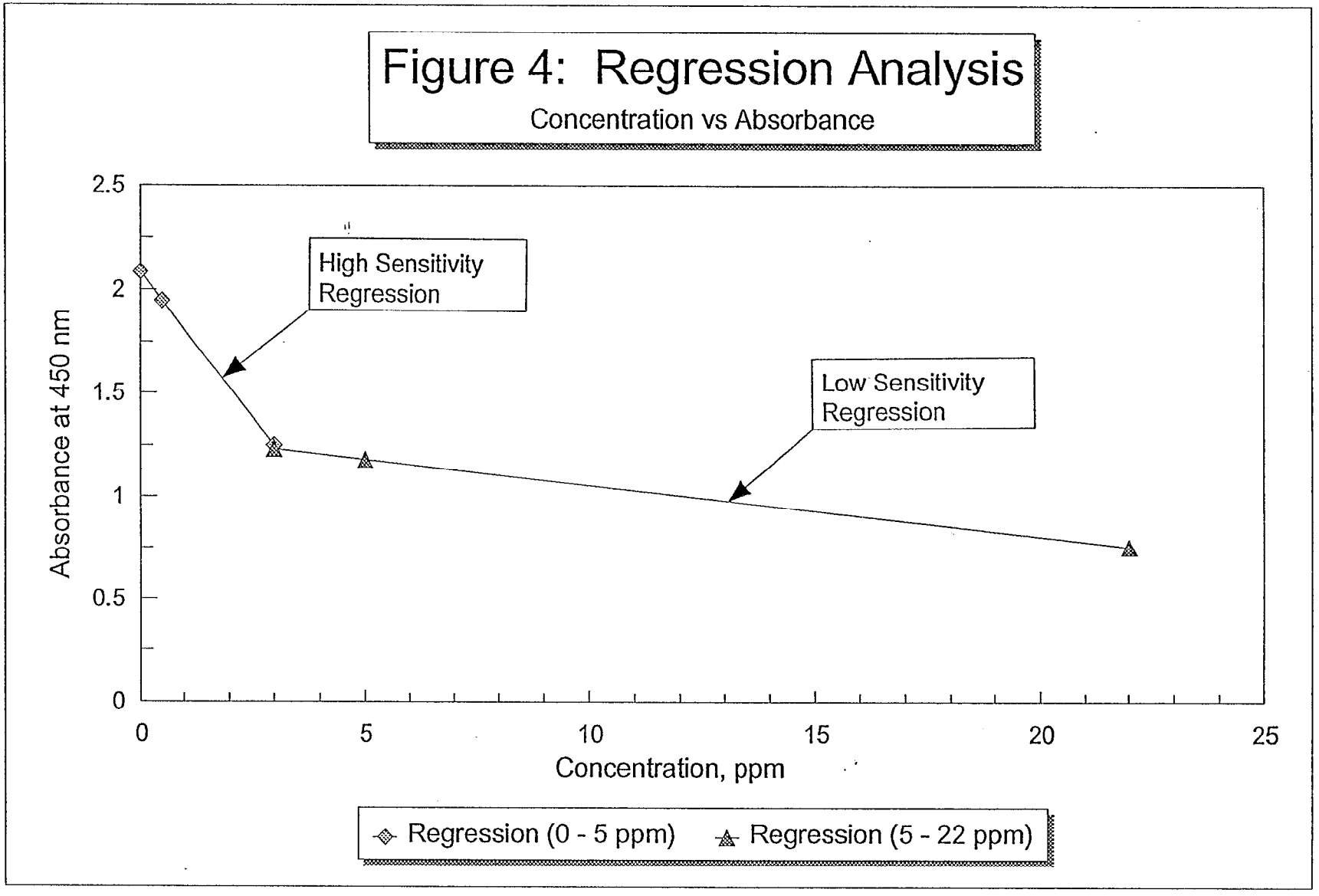
Sample	Absorbance 450 nm	Estimated Concentration, ppm (Based on Aroclor 1248)	Lab Confirmation Data	Interpretation
blank	2.2	0.00	--	No response
1 ppm	1.81	0.50	--	1 ppm action
5 ppm	1.27	3.00	--	5 ppm action
10 ppm	1.14	5.00	--	10 ppm action
50 ppm	0.76	22.00	--	50 ppm action
EPA-SC-1	1.86	0.81	--	<1
EPA-SC-2	1.22	3.49	--	>5, <10
EPA-SC-3	0.84	18.63	--	>10, <50
EPA-SC-4	1.11	7.87	--	>10, <50
EPA-SC-5	1	12.26	--	>10, <50
EPA-SS-16-05	0.97	13.45	4.4	>10, <50
EPA-SC-6	0.98	13.06	--	>10, <50
EPA-SS-16-01	2.15	<0.5	ND	<1
EPA-SC-7	1.82	0.95	--	<1
EPA-SC-8	1.98	0.38	--	<1
EPA-SC-9	1.94	0.52	--	<1

-- = not analyzed
ND = Not detected above quantitation limit

NOTE:
EPA-SC-1 through EPA-SC-6 were collected near Soil Sampling Stakes SS9 and SS10.
EPA-SC-7 through EPA-SC-9 were collected near Soil Sampling Stakes SS1, SS4, and SS6.
Sample EPA-SS-16-01 was collected near the limit of excavation, by the intermittent stream at the southeast side of site 16
Sample EPA-SS-16-05 was collected near Soil Sampling Stake SS2



Yorktown, NWS (SITE 16)



Yorktown, NWS (SITE 16)

- The arsenic concentration in samples EPA-SS-16-01 (4,000 ug/kg), EPA-SS-16-02 (900ug/kg), EPA-SS-16-03 (4,500 ug/kg), EPA-SS-16-04 (4,900 ug/kg), and EPA-SS-16-05 (3,000 ug/kg) exceeded the risk-based concentration for arsenic in residential soil (370 ug/kg). The beryllium and manganese concentrations in EPA-SS-16-03 (600 ug/kg beryllium and 484,000 ug/kg manganese) also exceeded the risk-based concentration for beryllium (150 ug/kg) and manganese (390,000 ug/kg) in residential soil.

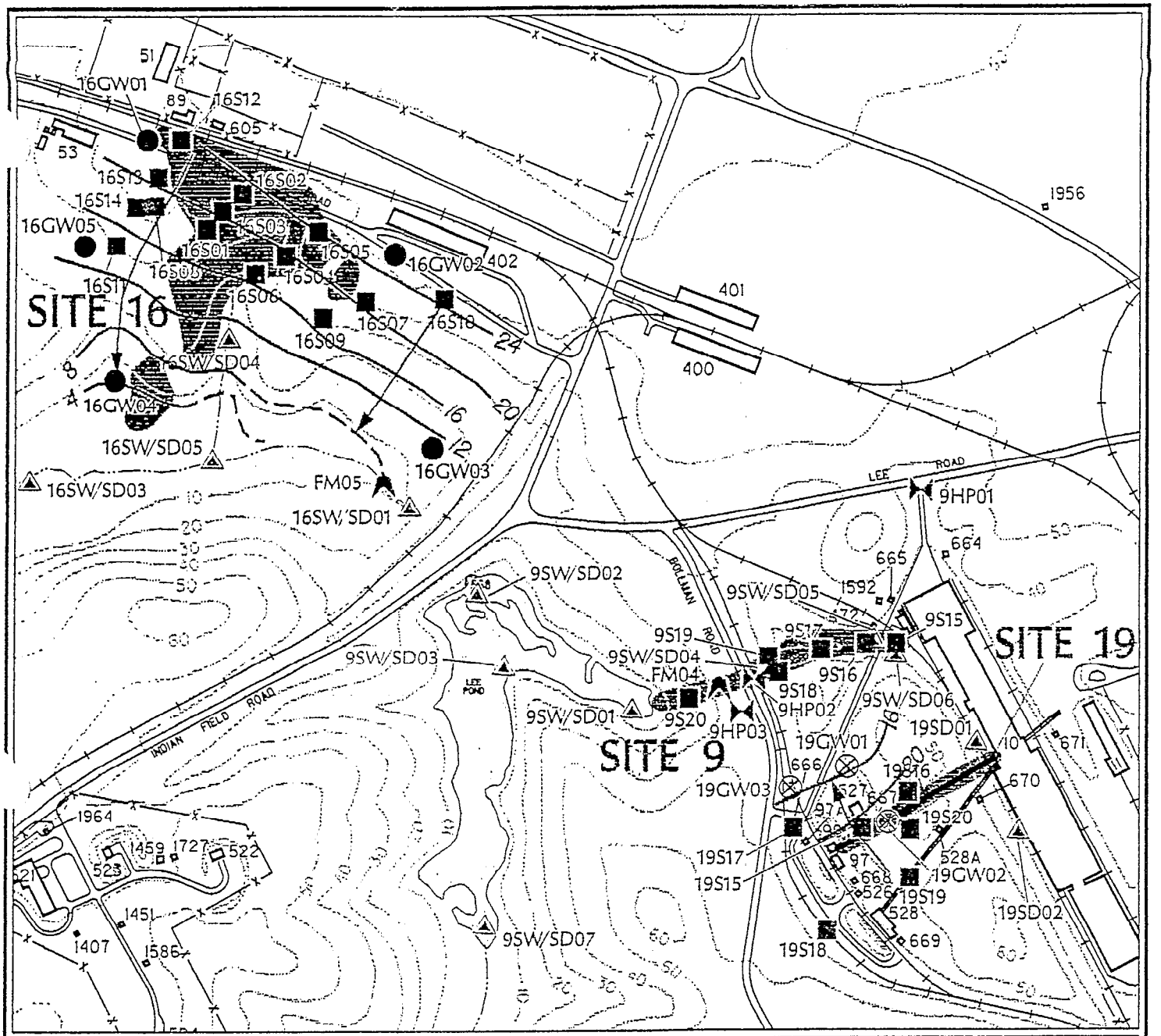
- Soil screening of 11 surface soil samples using immunoassay for PCBs has shown that 6 of the 11 samples detected positive for PCBs. Five of the positive detections were located at the origin of the drainage ditch to approximately 75 feet south along the drainage ditch. Sample EPA-SS-16-5 taken near IT sample SS-2 also screened positively for PCBs. Laboratory analysis of EPA-SS-16-5 confirmed the presence of PCBs, detecting aroclor 1254 at 1.4 ppm and aroclor 1260 at 3.0 ppm.

- The area of the drainage ditch where PCB detections were present was not part of the IT limited surface debris removal action. The sampling survey completed by Black & Veatch has demonstrated that a potential source area of contamination may remain at Site 16 in the vicinity or upgradient of the drainage ditch.

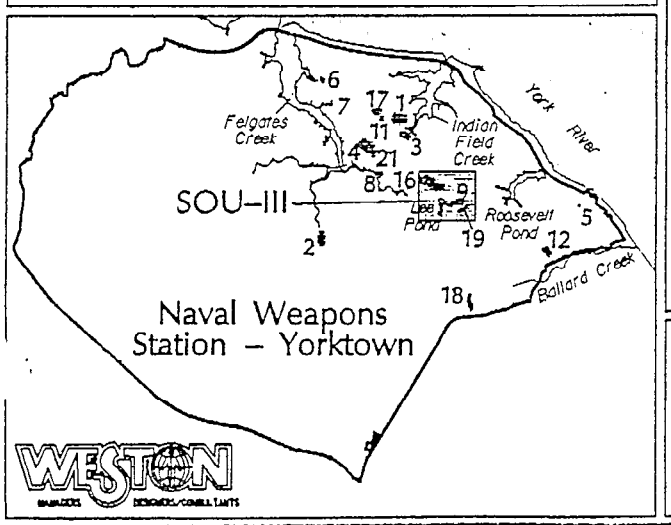
6.0 References

1. BLACK & VEATCH Waste Science, Inc., *Data Acquisition/Summary Report for Naval Weapons Station (NWS), Yorktown, Virginia*, May 1994.

2. R. L. Smith, EPA Region III, *Risk-Based Concentration Table, Third Quarter 1994*. July 11, 1994.



U. S. Navy
Naval Weapons Station
Yorktown, VA – March, 1993



36 Potentiometric Surface Contour
12GW02 Existing Monitoring Well Location
19GW01 Round One Monitoring Well Location
9SW/SD06 Round One Surface Water/Sediment Sampling Location
21S05 Round One Surface Soil Sample Location
17HP01 HydroPunch™ Sample Location
21FM01 Stream Flow Measurement Station
SITE 9 Remedial Investigation Site

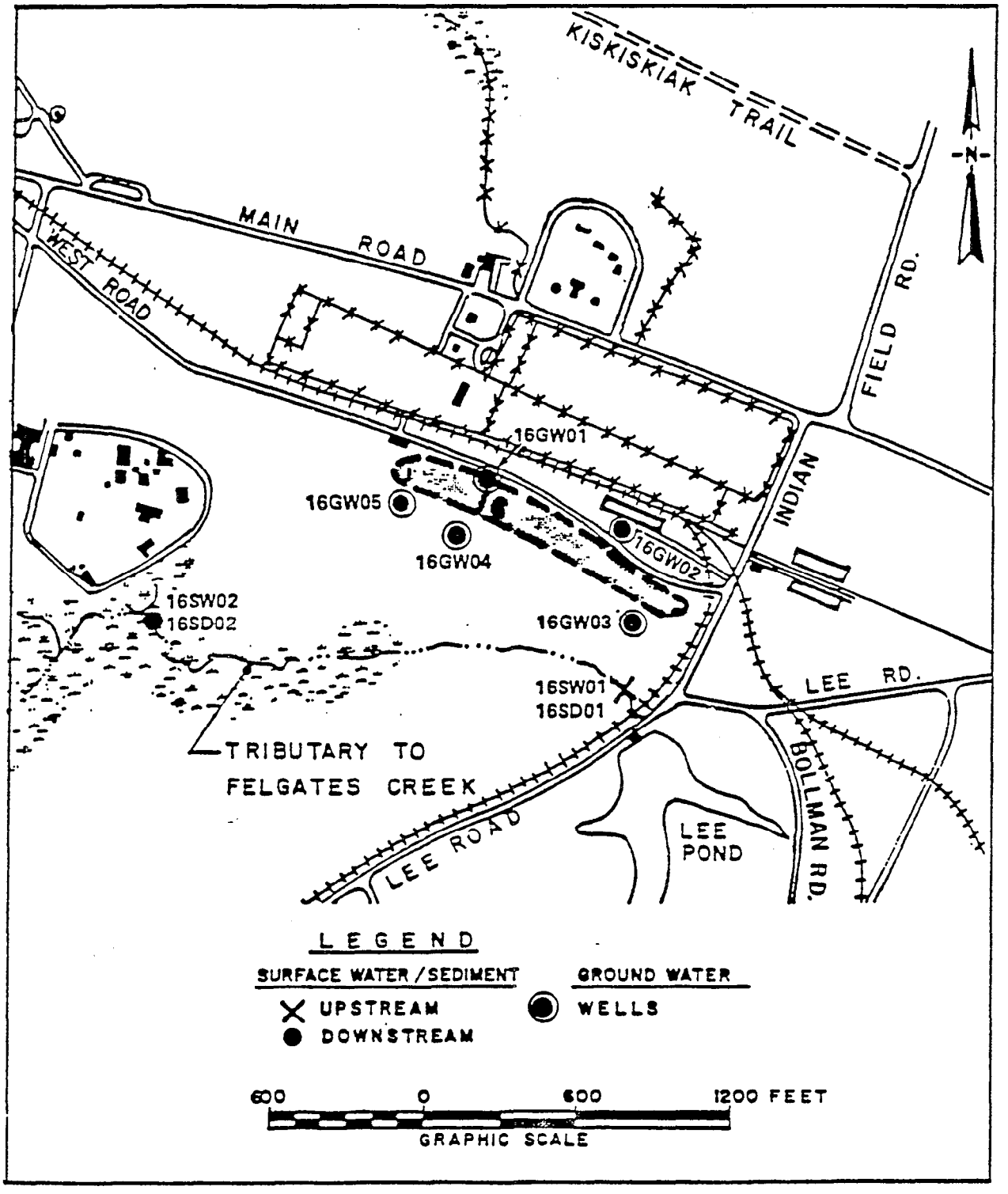
N

0 meters 100
0 feet 400

FIGURE 5.15: SOU-III (Site 9)
Round One, RI Sampling Locations
and Monitoring Wells
Lee Pond

FIGURE 5.18
SAMPLING LOCATIONS
CONFIRMATION STUDIES
ROUND ONE AND TWO

SITE 16: WEST ROAD LANDFILL



Analytical Parameters	Groundwater (ug/l)											
	16GW01		16GW02			16GW03			16GW03-101	16GW04		
	86	92	86	87	92	86	87	92	92	86	87	92
Purgeable Organics												
1,1,1-Trichloroethane	110	1J	-	-	-	-	-	-	-	<1.2	79	3J
1,1-Dichloroethane	-	-	-	-	-	<0.84	<5	2J	3J	<0.84	6	1J
1,1-Dichloroethylene	-	-	-	-	-	-	-	1J	-	<1.9	10	1J
1,4-Dichlorobenzene	-	-	-	-	-	-	-	-	-	-	-	-
Chlorobenzene	-	-	-	-	-	-	-	-	-	-	-	-
Methylene chloride	-	-	6	<5	<10	5.0	5.0	<10	-	13	14	<10
Methyl ethyl ketone	-	-	-	-	-	-	-	-	-	-	-	-
Trichloroethylene	-	-	-	-	-	-	-	-	-	-	-	-
Acetone	-	-	-	-	-	-	-	-	-	-	-	-
2-Hexanone	-	-	-	-	-	-	-	-	-	-	-	-
Toluene	-	-	-	-	-	-	-	-	-	-	-	-
4-Methylphenol	-	-	-	-	-	-	-	-	-	-	-	-
Phenol	-	-	-	-	-	-	-	-	-	<2.0	<3.0	1J
BNA Extractables												
Bis(2-ethylhexyl)Phthalate	20	<10	-	-	-	313	485	<10	-	88	<10	<10
Di-n-octyl phthalate	-	-	-	-	-	51	61.3	<10	-	-	-	-
Fluoranthene	-	-	-	-	-	-	-	-	-	-	-	-
Chrysene	-	-	-	-	-	-	-	-	-	-	-	-
Pyrene	-	-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(a)anthracene	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(b)fluoranthene	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(a)pyrene	-	-	-	-	-	-	-	-	-	-	-	-
Total phenols	2.0	<10	<2.0	3.4	<10	-	-	-	-	-	-	-
Di-n-butylphthalate	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(k)fluoranthene	-	-	-	-	-	-	-	-	-	-	-	-
Styrene	-	-	-	-	-	-	-	-	-	-	-	-
Anthracene	-	-	-	-	-	-	-	-	-	-	-	-
Carbazole	-	-	-	-	-	-	-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	-	-	-	-	-	-	-	-	-	-	-	-

Analytical Parameters	Groundwater (ug/l)											
	16GW01		16GW02			16GW03			16GW03-101	16GW04		
	86	92	86	87	92	86	87	92	92	86	87	92
Dibenzo(g,h)anthracene	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	-	-	-	-	-	-	-	-	-	-	-	-
Pesticides/PCBs												
Delta-BHC	0.084	<0.05	-	-	-	-	-	-	-	-	-	-
Gamma-BHC	-	-	-	-	-	-	-	-	-	-	-	-
4,4'-DDE	-	-	-	-	-	-	-	-	-	-	-	-
4,4'-DDD	-	-	-	-	-	-	-	-	-	-	-	-
4,4'-DDT	-	-	-	-	-	-	-	-	-	-	-	-
Dieldrin	-	-	-	-	-	-	-	-	-	-	-	-
Heptachlor	0.024	<0.05	-	-	-	-	-	-	-	-	-	-
Aroclor 1254	-	-	-	-	-	-	-	-	-	-	-	-
Aroclor 1248	-	-	-	-	-	-	-	-	-	-	-	-
Aroclor 1260	-	-	-	-	-	-	-	-	-	-	-	-
Explosives												
RDX	-	1.3	-	-	-	-	-	-	-	-	-	-
4-Amino-2,6-dinitrotoluene	-	-	-	-	-	-	-	-	-	-	-	-
2-Amino-4,6-dinitrotoluene	-	-	-	-	-	-	-	-	-	-	-	-
2,4-Diamino-6-nitrotoluene	-	-	-	-	-	-	-	-	-	-	-	-
2,6-Diamino-4-nitrotoluene	-	-	-	-	-	-	-	-	-	-	-	-

Analytical Parameters	Groundwater (ug/l)											
	16GW01		16GW02			16GW03			16GW03-101	16GW04		
	86	92	86	87	92	86	87	92	92	86	87	92
Miscellaneous												
Oil and grease	<5.000	-	<5.000	<5.000	-	<5.000	<5.000	-	-	-	-	-
pH	5.5	4.9	7.6	6.94	7.2	7.8	7.62	7.2	-	-	-	6.9
Sp Cond (umhos/cm @ 25C)	-	55	-	582	430	-	420	270	-	-	490	260

Notes: J = Estimated Value
+ - Exceeds NOAA apparent effects threshold
* = Meets or exceeds NOAA low effects range criteria
** = Meets or exceeds NOAA median effects range criteria
- = Not detected or rejected due to quality control
Source: Versar, 1991 and Baker Environmental, Inc./Weston, 1993.

Table 5.13 Site 16: Confirmation Study and Round One RI Selected Chemical Data Organics and Miscellaneous

Analytical Parameters	Groundwater (ug/l)			Surface Water (ug/l)					Sediment Samples, (ug/kg)			
	16GW05			16SW01		16SW02		16SW03-001	16SD01		16SD01-001	16SD01-002
	86	87	92	86	87	86	87	92	86	87	92	92
Purgeable Organics												
1,1,1-Trichloroethane	<1.2	<5	1J	-	-	-	-	8J	-	-	-	-
1,1-Dichloroethane	-	-	-	-	-	-	-	5J	-	-	-	-
1,1-Dichloroethylene	-	-	-	-	-	-	-	2J	-	-	-	-
1,4-Dichlorobenzene	<5.6	<10	4J	-	-	-	-	-	-	-	-	-
Chlorobenzene	<0.63	<5	6J	-	-	-	-	-	-	-	-	-
Methylene chloride	<1.1	32	<10	12.0	9	18.0	8	-	111.5	139	-	-
Methyl ethyl ketone	-	-	-	14	<10	12.0	<10	-	-	-	-	-
Trichloroethylene	-	-	-	-	-	5.0	<5	-	-	-	-	-
Acetone	-	-	-	-	10	-	-	-	-	51	-	-
2-Hexanone	-	-	-	-	-	-	-	-	-	17	-	-
Toluene	-	-	-	-	-	-	-	-	-	-	-	-
4-Methylphenol	-	-	-	-	-	-	-	850	-	-	-	-
Phenol	-	-	-	-	-	-	-	27J	-	-	-	-
BNA Extractables												
Bis(2-ethylhexyl)Phthalate	<9.8	15.9	<10	-	-	-	-	-	-	-	-	-
Di-n-octyl phthalate	-	-	-	-	-	-	-	-	<108	489	-	-
Fluoranthene	-	-	-	-	-	-	-	-	395	1151	-	190J
Chrysene	-	-	-	-	-	-	-	-	172	429	-	75J
Pyrene	-	-	-	-	-	-	-	-	326	890	-	81J
Phenanthrene	-	-	-	-	-	-	-	-	324	859	-	77J
Benzo(a)anthracene	-	-	-	-	-	-	-	-	<150	391	-	74J
Benzo(b)fluoranthene	-	-	-	-	-	-	-	-	<187	371	-	59J
Benzo(a)pyrene	-	-	-	-	-	-	-	-	<208	456	-	50J
Total phenols	3.0	3.3	<10	-	-	3.0	6	-	-	-	-	-
Di-n-butylphthalate	-	-	-	-	-	-	-	-	-	-	570	160J
Benzo(k)fluoranthene	-	-	-	-	-	-	-	-	-	-	-	64J
Styrene	-	-	-	-	-	-	-	-	-	-	-	-
Anthracene	-	-	-	-	-	-	-	-	-	-	-	21J
Carbazole	-	-	-	-	-	-	-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	-	-	-	-	-	-	-	-	-	-	-	42J

Table 5.13 Site 16: Confirmation Study and Round One RI Selected Chemical Data Organics and Miscellaneous

Analytical Parameters	Groundwater (ug/l)			Surface Water (ug/l)					Sediment Samples, (ug/kg)			
	16GW05			16SW01		16SW02		16SW03-001	16SD01		16SD01-001	16SD01-002
	86	87	92	86	87	86	87	92	86	87	92	92
Dibenzo(g,h)anthracene	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	-	-	-	-	-	-	-	-	-	-	-	-
Pesticidess/PCBs												
Delta-BHC	-	-	-	-	-	0.012	<0.05	-	15.5	<80	-	-
Gamma-BHC	-	-	-	-	-	0.024	<0.05	-	-	-	-	-
4,4'-DDE	-	-	-	-	-	-	-	-	-	-	-	-
4,4'-DDD	-	-	-	-	-	-	-	-	-	-	-	-
4,4'-DDT	-	-	-	-	-	-	-	-	-	-	-	-
Dieldrin	-	-	-	-	-	-	-	-	13.6	<160	-	-
Heptachlor	-	-	-	-	-	-	-	-	-	-	-	-
Aroclor 1254	-	-	-	-	-	-	-	-	-	-	-	-
Aroclor 1248	-	-	-	-	-	-	-	-	-	-	-	-
Aroclor 1260	-	-	-	-	-	-	-	-	-	-	-	-
Explosives												
RDX	-	-	-	-	2.01	-	0.86	-	-	-	-	-
4-Amino-2,6-dinitrotoluene	-	-	-	-	3	-	-	-	-	-	-	-
2-Amino-4,6-dinitrotoluene	-	-	-	-	2.3	-	2.3	-	-	-	-	-
2,4-Diamino-6-nitrotoluene	-	-	-	-	0.67	-	-	-	-	-	-	-
2,6-Diamino-4-nitrotoluene	-	-	-	-	0.76	-	0.58	-	-	-	-	-

Analytical Parameters	Groundwater (ug/l)			Surface Water (ug/l)					Sediment Samples, (ug/kg)			
	16GW05			16SW01		16SW02		16SW03-001	16SD01		16SD01-001	16SD01-002
	86	87	92	86	87	86	87	92	86	87	92	92
Miscellaneous												
Oil and grease	<5.000	<5.000	-	<5.000	<5.000	<5.000	<5.000	-	225.300	553,000	-	-
pH	6.0	4.98	5.6	7.6	7.15	7.7	7.64	6.9	-	-	7.3	-
Sp Cond (umhos/cm @ 25C)	-	100	93	-	740	-	2,700	425	-	-	-	-

Notes: J = Estimated Value
+ - Exceeds NOAA apparent effects threshold
* = Meets or exceeds NOAA low effects range criteria
** = Meets or exceeds NOAA median effects range criteria
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Source: Versar, 1991 and Baker Environmental, Inc./Weston, 1993.

Table 5.13

Site 16: Confirmation Study and Round One RI Selected Chemical Data

Organics and Miscellaneous

Analytical Parameters	Sediment Samples, (ug/kg)								Surface Soil, (ug/kg)	
	16SD02		16SD-03-001	16SD-03-002	16SD-04-001	16SD-04-002	16SD-05-001	16SD-05-002	16S01-001	16S01-101
	86	87	92	92	92	92	92	92	92	92
Purgeable Organics										
1,1,1-Trichloroethane	-	-	-	-	-	-	-	-	-	-
1,1-Dichloroethane	-	-	-	-	-	-	-	-	-	-
1,1-Dichloroethylene	-	-	-	-	-	-	-	-	-	-
1,4-Dichlorobenzene	-	-	-	-	-	-	-	-	-	-
Chlorobenzene	-	-	-	-	-	-	-	-	-	-
Methylene chloride	50.2	38	-	-	-	-	-	-	-	-
Methyl ethyl ketone	20.3	<22	-	-	-	-	-	-	-	-
Trichloroethylene	21.3	<11	-	-	-	-	-	-	-	-
Acetone	-	87	-	-	-	-	-	-	-	-
2-Hexanone	-	22	-	-	-	-	-	-	-	-
Toluene	-	-	-	-	-	-	-	-	-	-
4-Methylphenol	-	-	410J	160J	1000	-	-	-	-	-
Phenol	-	-	-	-	-	-	-	-	-	-
BNA Extractables										
Bis(2-ethylhexyl)Phthalate	-	-	-	-	-	-	-	-	-	-
Di-n-octyl phthalate	<108	491	-	-	-	-	-	-	-	-
Fluoranthene	-	-	-	-	-	-	-	-	-	-
Chrysene	-	-	-	-	-	-	-	-	-	-
Pyrene	-	-	-	-	-	-	-	-	-	-
Phenanthrene	-	-	-	-	-	-	-	-	-	-
Benzo(a)anthracene	-	-	-	-	-	-	-	-	-	-
Benzo(b)fluoranthene	-	-	-	-	-	-	-	-	-	-
Benzo(a)pyrene	-	-	-	-	-	-	-	-	-	-
Total phenols	-	-	-	-	-	-	-	-	-	-
Di-n-butylphthalate	-	-	310J	380J	-	630	380J	140J	-	-
Benzo(k)fluoranthene	-	-	-	-	-	-	-	-	-	-
Styrene	-	-	-	-	-	-	-	-	-	-
Anthracene	-	-	-	-	-	-	-	-	-	-
Carbazole	-	-	-	-	-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	-	-	-	-	-	-	-	-	-	-

Table 5.13 Site 16: Confirmation Study and Round One RI Selected Chemical Data Organics and Miscellaneous

Analytical Parameters	Sediment Samples, (ug/kg)								Surface Soil, (ug/kg)	
	16SD02		16SD-03-001	16SD-03-002	16SD-04-001	16SD-04-002	16SD-05-001	16SD-05-002	16S01-001	16S01-101
	86	87	92	92	92	92	92	92	92	92
Dibenzo(g,h)anthracene	-	-	-	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	-	-	-	-	-	-	-	-	-	-
Pesticidess/PCBs										
Delta-BHC	-	-	-	-	-	-	-	-	-	-
Gamma-BHC	-	-	-	-	-	-	-	-	-	-
4,4'-DDE	-	-	-	-	-	-	-	-	1.5J	0.82J
4,4'-DDD	-	-	-	-	-	-	-	-	2.3J	1.2J
4,4'-DDT	-	-	-	-	-	-	-	-	1.9J	1.2J
Dieldrin	-	-	-	-	-	-	-	-	-	-
Heptachlor	-	-	-	-	-	-	-	-	-	-
Aroclor 1254	-	-	-	-	59J*	25J	-	-	-	-
Aroclor 1248	-	-	-	-	-	-	-	-	-	-
Aroclor 1260	-	-	-	-	-	-	-	-	-	-
Explosives										
RDX	-	-	-	-	-	-	-	-	-	-
4-Amino-2,6-dinitrotoluene	-	-	-	-	-	-	-	-	-	-
2-Amino-4,6-dinitrotoluene	-	-	-	-	-	-	-	-	-	-
2,4-Diamino-6-nitrotoluene	-	-	-	-	-	-	-	-	-	-
2,6-Diamino-4-nitrotoluene	-	-	-	-	-	-	-	-	-	-

Table 5.13 Site 16: Confirmation Study and Round One RI Selected Chemical Data Organics and Miscellaneous

Analytical Parameters	Sediment Samples, (ug/kg)								Surface Soil, (ug/kg)	
	16SD02		16SD-03-001	16SD-03-002	16SD-04-001	16SD-04-002	16SD-05-001	16SD-05-002	16S01-001	16S01-101
	86	87	92	92	92	92	92	92	92	92
Miscellaneous										
Oil and grease	207.600	443,000	-	-	-	-	-	-	-	-
pH	-	-	7	6.9	6.6	7.1	7	7.3	6	-
Sp Cond (umhos/cm @ 25C)	-	-	-	-	-	-	-	-	-	-

Notes: J = Estimated Value
+ - Exceeds NOAA apparent effects threshold
* = Meets or exceeds NOAA low effects range criteria
** = Meets or exceeds NOAA median effects range criteria
- = Not detected or rejected due to quality control
Source: Versar, 1991 and Baker Environmental, Inc./Weston, 1993.

Table 5.13

Site 16: Confirmation Study and Round One RI Selected Chemical Data

Organics and Miscellaneous

Analytical Parameters	Surface Soil, (ug/kg)										
	16S02-001	16S03-001	16S04-001	16S05-001	16S06-001	16S07-001	16S08-001	16S09-001	16S10-001	16S12-001	16S12-101
	92	92	92	92	92	92	92	92	92	92	92
Purgeable Organics											
1,1,1-Trichloroethane	-	-	-	-	-	-	-	-	-	-	-
1,1-Dichloroethane	-	-	-	-	-	-	-	-	-	-	-
1,1-Dichloroethylene	-	-	-	-	-	-	-	-	-	-	-
1,4-Dichlorobenzene	-	-	-	-	-	-	-	-	-	-	-
Chlorobenzene	-	-	-	-	-	-	-	-	-	-	-
Methylene chloride	-	-	-	-	-	-	-	-	-	-	-
Methyl ethyl ketone	-	-	-	-	-	-	-	-	-	-	-
Trichloroethylene	-	-	-	-	-	-	-	-	-	-	-
Acetone	-	-	-	-	-	-	-	-	-	-	-
2-Hexanone	-	-	-	-	-	-	-	-	-	-	-
Toluene	-	-	-	2J	-	-	-	-	-	-	-
4-Methylphenol	-	-	-	-	-	-	-	-	-	-	-
Phenol	-	-	-	-	-	-	-	-	-	20J	-
BNA Extractables											
Bis(2-ethylhexyl)Phthalate	-	-	700J	590	350	330J	280J	300J	220J	-	-
Di-n-octyl phthalate	-	-	-	-	-	-	-	-	-	-	-
Fluoranthene	-	-	61J	150J	-	280J	-	-	20J	260J	130J
Chrysene	-	-	35J	91J	-	140J	-	-	-	160J	86J
Pyrene	-	-	57J	130J	-	200J	-	-	19J	180J	88J
Phenanthrene	-	-	24J	58J	-	140J	-	-	-	99J	52J
Benzo(a)anthracene	-	-	33J	74J	-	140J	-	-	-	130J	66J
Benzo(b)fluoranthene	-	-	43J	120J	-	94J	-	-	-	160J	76J
Benzo(a)pyrene	-	-	35J	66J	-	98J	-	-	-	130J	72J
Total phenols	-	-	-	-	-	-	-	-	-	-	-
Di-n-butylphthalate	35J	-	65J	110J	96J	70J	-	59J	44J	-	-
Benzo(k)fluoranthene	-	-	34J	83J		100J	66J			95J	81J
Styrene	-	-	-	-	5J	-	-	-	-	-	-
Anthracene	-	-	-	-	-	44J	-	-	-	-	-
Carbazole	-	-	-	-	-	54J	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	-	-	-	-	-	64J	-	-	-	150J	86J

Analytical Parameters	Surface Soil, (ug/kg)										
	16S02-001	16S03-001	16S04-001	16S05-001	16S06-001	16S07-001	16S08-001	16S09-001	16S10-001	16S12-001	16S12-101
	92	92	92	92	92	92	92	92	92	92	92
Dibenzo(g,h)anthracene	-	-	-	-	-	-	-	-	-	51J	-
Benzo(g,h,i)perylene	-	-	-	-	-	-	-	-	-	150J	84J
Pesticides/PCBs											
Delta-BHC	-	-	-	-	-	-	-	-	-	-	-
Gamma-BHC	-	-	-	-	-	-	-	-	-	-	-
4,4'-DDE	-	-	-	-	-	-	-	-	-	6.5	6.3
4,4'-DDD	-	-	-	-	-	-	-	-	-	-	-
4,4'-DDT	-	-	-	-	-	-	-	1.4J	-	-	-
Dieldrin	7.7	0.40J	-	-	-	-	-	-	-	-	-
Heptachlor	-	-	-	-	-	-	-	-	-	-	-
Aroclor 1254	-	-	550	880	26J	20J	13J	-	16J	87	87
Aroclor 1248	-	-	-	-	-	-	-	-	-	24J	-
Aroclor 1260	-	-	-	-	-	-	-	-	-	110	120
Explosives											
RDX	-	-	-	-	-	-	-	-	-	-	-
4-Amino-2,6-dinitrotoluene	-	-	-	-	-	-	-	-	-	-	-
2-Amino-4,6-dinitrotoluene	-	-	-	-	-	-	-	-	-	-	-
2,4-Diamino-6-nitrotoluene	-	-	-	-	-	-	-	-	-	-	-
2,6-Diamino-4-nitrotoluene	-	-	-	-	-	-	-	-	-	-	-

Analytical Parameters	Surface Soil, (ug/kg)										
	16S02-001	16S03-001	16S04-001	16S05-001	16S06-001	16S07-001	16S08-001	16S09-001	16S10-001	16S12-001	16S12-101
	92	92	92	92	92	92	92	92	92	92	92
Miscellaneous											
Oil and grease	-	-	-	-	-	-	-	-	-	-	-
pH	5.9	4.9	6.7	7.2	5.4	6.6	5	5.2	7	6.9	-
Sp Cond (umhos/cm @ 25C)	-	-	-	-	-	-	-	-	-	-	-

Notes:
J = Estimated Value
+ - Exceeds NOAA apparent effects threshold
* = Meets or exceeds NOAA low effects range criteria
** = Meets or exceeds NOAA median effects range criteria
- = Not detected or rejected due to quality control
Source: Versar, 1991 and Baker Environmental, Inc./Weston, 1993.

Table 5.13

Site 16: Confirmation Study and Round One RI Selected Chemical Data

Metals and Nitrates

Analytical Parameters	Groundwater (ug/l)											
	16GW01		16GW02			16GW03			16GW03-101	16GW04		
	86	92	86	87	92	86	87	92	92	86	87	92
Metals										-	-	
Antimony	<4	48.3	12.7	<3.0	<60	4.7	<3.0	3.1	2.7	5	<3	17.8
Arsenic	<4	10.6	-	-	<10	<4	<3.1	3.1	2.7	<4	<3.1	17.8
Barium	-	241*	-	-	65.1	-	-	53.1	53.1	-	-	362*
Cadmium	-	-	-	-	<5	-	-	-	-	-	-	5.70J
Chromium	<4	313*	<4	-	14.3	<4	<4.0	15.4	16.1	<4	<4.0	234*
Copper	<4	58.40J*	<4	-	<25	-	-	-	-	-	-	-
Lead	1.6	56.00*	1.8	<2.5	<3	1.2	<2.5	18.4	20	1.3	<2.5	43.50*
Mercury	-	0.2	-	-	-	-	-	-	-	-	-	0.25
Nickel	-	30.7	-	-	-	-	-	-	20.1	-	-	-
Silver	-	-	-	-	-	-	-	-	-	-	-	-
Thallium	-	-	-	-	-	-	-	-	-	-	-	-
Zinc	72	233*	51	16	19.9	39	13	17.1	21.7	42	4.6	10.8
Miscellaneous								-		-	-	
Nitrates	-	2000	-	-	440	-	-	110	-	-	-	-

Notes: J = Estimated Value
For Metals
* = Compound is present > twice maximum backgound
for Round One RI
Source: Versar, 1991 and Baker Environmental, Inc./Weston, 1993.
- = not detected or rejected due to quality control

Table 5.13

Site 16: Confirmation Study and Round One RI Selected Chemical Data

Metals and Nitrates

Analytical Parameters	Groundwater (ug/l)			Surface Water (ug/l)				Sediment Samples, (ug/kg)			
	16GW05			16SW01		16SW02		16SD01		16SD02	
	86	87	92	86	87	86	87	86	87	86	87
Metals											
Antimony	-	-	-	<4	5.8	-	-	-	-	-	-
Arsenic	-	-	-	-	-	-	-	4,000	7,500	<4,000	6,800
Barium	-	-	57.1	-	-	-	-	-	-	-	-
Cadmium	-	-	-	-	-	-	-	-	-	-	-
Chromium	<4	<4.0	13.2	6.0	<4.0	5.0	<4.0	6,000	28,000	6,000	34,000
Copper	<4	5.1	<25	-	-	<4	4	<4,000	10,000	-	-
Lead	<1	<2.5	10.4	-	-	-	-	<10,000	18,800	<10,000	8,400
Mercury	-	-	-	-	-	-	-	-	-	-	-
Nickel	-	-	-	-	-	-	-	-	-	-	-
Silver	-	-	-	-	-	-	-	-	-	<1,000	300
Thallium	-	-	-	-	-	4.4	<2.5	-	-	-	-
Zinc	51	14	13.2	39.0	24	32.0	13	40,600	114,000	10,700	51,000
Miscellaneous											
Nitrates	-	-	2800	-	-	-	-	-	-	-	-

Notes: J = Estimated Value

For Metals

* = Compound is present > twice maximum backgound for Round One RI

Source: Versar, 1991 and Baker Environmental, Inc./Weston, 1993.

- = not detected or rejected due to quality control

Table 5.13 Site 16: Confirmation Study and Round One RI Selected Chemical Data Metals and Nitrates

Analytical Parameters	Groundwater (ug/l)											
	16GW01		16GW02			16GW03			16GW03-101	16GW04		
	86	92	86	87	92	86	87	92	92	86	87	92
Metals										-	-	
Antimony	<4	48.3	12.7	<3.0	<60	4.7	<3.0	3.1	2.7	5	<3	17.8
Arsenic	<4	10.6	-	-	<10	<4	<3.1	3.1	2.7	<4	<3.1	17.8
Barium	-	241*	-	-	65.1	-	-	53.1	53.1	-	-	362*
Cadmium	-	-	-	-	<5	-	-	-	-	-	-	5.70J
Chromium	<4	313*	<4	-	14.3	<4	<4.0	15.4	16.1	<4	<4.0	234*
Copper	<4	58.40J*	<4	-	<25	-	-	-	-	-	-	-
Lead	1.6	56.00*	1.8	<2.5	<3	1.2	<2.5	18.4	20	1.3	<2.5	43.50*
Mercury	-	0.2	-	-	-	-	-	-	-	-	-	0.25
Nickel	-	30.7	-	-	-	-	-	-	20.1	-	-	-
Silver	-	-	-	-	-	-	-	-	-	-	-	-
Thallium	-	-	-	-	-	-	-	-	-	-	-	-
Zinc	72	233*	51	16	19.9	39	13	17.1	21.7	42	4.6	10.8
Miscellaneous								-		-	-	
Nitrates	-	2000	-	-	440	-	-	110	-	-	-	-

Notes: J = Estimated Value
For Metals
* = Compound is present > twice maximum backgound
for Round One RI
Source: Versar, 1991 and Baker Environmental, Inc./Weston, 1993.
- = not detected or rejected due to quality control

Table 5.13 Site 16: Confirmation Study and Round One RI Selected Chemical Data Metals and Nitrates

Analytical Parameters	Groundwater (ug/l)			Surface Water (ug/l)				Sediment Samples, (ug/kg)			
	16GW05			16SW01		16SW02		16SD01		16SD02	
	86	87	92	86	87	86	87	86	87	86	87
Metals											
Antimony	-	-	-	<4	5.8	-	-	-	-	-	-
Arsenic	-	-	-	-	-	-	-	4,000	7,500	<4,000	6,800
Barium	-	-	57.1	-	-	-	-	-	-	-	-
Cadmium	-	-	-	-	-	-	-	-	-	-	-
Chromium	<4	<4.0	13.2	6.0	<4.0	5.0	<4.0	6,000	28,000	6,000	34,000
Copper	<4	5.1	<25	-	-	<4	4	<4,000	10,000	-	-
Lead	<1	<2.5	10.4	-	-	-	-	<10,000	18,800	<10,000	8,400
Mercury	-	-	-	-	-	-	-	-	-	-	-
Nickel	-	-	-	-	-	-	-	-	-	-	-
Silver	-	-	-	-	-	-	-	-	-	<1,000	300
Thallium	-	-	-	-	-	4.4	<2.5	-	-	-	-
Zinc	51	14	13.2	39.0	24	32.0	13	40,600	114,000	10,700	51,000
Miscellaneous											
Nitrates	-	-	2800	-	-	-	-	-	-	-	-

Notes: J = Estimated Value
For Metals
* = Compound is present > twice maximum backgound
for Round One RI
Source: Versar, 1991 and Baker Environmental, Inc./Weston, 1993.
- = not detected or rejected due to quality control

Schlette

Element Concentrations in Soils and Other Surficial Materials of the Conterminous United States

By HANSFORD T. SHACKLETTE and JOSEPHINE G. BOERNGEN

U.S. GEOLOGICAL SURVEY PROFESSIONAL PAPER 1270

An account of the concentrations of 50 chemical elements in samples of soils and other regoliths

UNITED STATES GOVERNMENT PRINTING OFFICE, WASHINGTON : 1984

1, unlike the geometric means shown in table 2, are estimates of geochemical abundance (Miesch, 1967). Arithmetic means are always larger than corresponding geometric means (Miesch, 1967, p. B1) and are estimates of the fractional part of a single specimen that consists of the element of concern rather than of the typical concentration of the element in a suite of samples.

Concentrations of 46 elements in samples of this study are presented in table 2, which gives the determination ratios, geometric-mean concentrations and deviations, and observed ranges in concentrations. The analytical data for most elements as received from the laboratories were transformed into logarithms because of the tendency for elements in natural materials, particularly the trace elements, to have positively skewed

TABLE 2.—*Mean concentrations, deviations, and ranges of elements in samples of soils and other surficial materials in the conterminous United States*

[Means and ranges are reported in parts per million (μg/g), and means and deviations are geometric except as indicated. Ratio, number of samples in which the element was found in measurable concentrations to number of samples analyzed. <, less than; >, greater than]

Element	Conterminous United States			Western United States (west of 96th meridian)					Eastern United States (east of 96th meridian)				
	Mean	Deviation	Estimated arithmetic mean	Ratio	Mean	Deviation	Observed range	Estimated arithmetic mean	Ratio	Mean	Deviation	Observed range	Estimated arithmetic mean
Al, percent	4.7	2.48	7.2	661:770	5.8	2.00	0.5 - >10	7.4	450:477	3.3	2.87	0.7 - >10	5.7
As	5.2	2.23	7.2	728:730	5.5	1.98	<0.10 - 97	7.0	521:527	4.8	2.56	<0.1 - 73	7.4
B	26	1.97	33	506:778	23	1.99	<20 - 300	29	425:561	31	1.88	<20 - 150	38
Ba	440	2.14	580	778:778	580	1.72	70 - 5,000	670	541:541	290	2.35	10 - 1,500	420
Be	.63	2.38	.92	310:778	.68	2.30	<1 - 15	.97	169:525	.55	2.53	<1 - 7	.85
Br	.36	2.50	.85	113:220	.52	2.74	<0.5 - 11	.86	78:128	.62	2.18	<0.5 - 5.3	.85
C, percent	1.6	2.57	2.5	250:250	1.7	2.37	0.16 - 10	2.5	162:162	1.5	2.88	0.06 - 37	2.6
Ca, percent	.92	4.00	2.4	777:777	1.8	3.05	0.06 - 32	3.3	514:514	.34	3.08	0.01 - 28	.63
Ce	63	1.78	75	81:683	65	1.71	<150 - 300	75	70:489	63	1.85	<150 - 300	76
Co	6.7	2.19	9.1	698:778	7.1	1.97	<3 - 50	9.0	403:533	5.9	2.57	<0.3 - 70	9.2
Cr	37	2.37	54	778:778	41	2.19	3 - 2,000	56	541:541	33	2.60	1 - 1,000	52
Cu	17	2.44	25	778:778	21	2.07	2 - 300	27	523:533	13	2.80	<1 - 700	22
F	210	3.34	430	598:610	280	2.52	<10 - 1,900	440	390:435	130	4.19	<10 - 3,700	360
Fe, percent	1.8	2.38	2.6	776:777	2.1	1.95	0.1 - >10	2.6	539:540	1.4	2.87	0.01 - >10	2.5
Ga	13	2.03	17	767:776	16	1.68	<5 - 70	19	431:540	9.3	2.38	<5 - 70	14
Ge	1.2	1.37	1.2	224:224	1.2	1.32	0.58 - 2.5	1.2	130:131	1.1	1.45	<0.1 - 2.0	1.2
Hg	.058	2.52	.089	729:733	.046	2.33	<0.01 - 4.6	.065	534:534	.081	2.52	0.01 - 3.4	.12
I	.75	2.63	1.2	169:246	.79	2.55	<0.5 - 9.6	1.2	90:153	.68	2.81	<0.5 - 7.0	1.2
K, percent[1]	1.5	.79	None	777:777	1.8	.71	0.19 - 6.3	None	537:537	1.2	.75	0.005 - 3.7	—
La	30	1.92	37	462:777	30	1.89	<30 - 200	37	294:516	29	1.98	<30 - 200	37
Li	20	1.85	24	731:731	22	1.58	5 - 130	25	479:527	17	2.16	<5 - 140	22
Mg, percent	.44	3.28	.90	777:778	.74	2.21	0.03 - >10	1.0	528:528	.21	3.55	0.005 - 5	.46
Mn	330	2.77	550	777:777	380	1.98	30 - 5,000	480	537:540	260	3.82	<2 - 7,000	640
Mo	.59	2.72	.97	57:774	.85	2.17	<3 - 7	1.1	32:524	.32	3.93	<3 - 15	.79
Na, percent	.59	3.27	1.2	744:744	.97	1.95	0.05 - 10	1.2	363:449	.25	4.35	<0.05 - 5	.78
Nb	9.3	1.75	11	418:771	8.7	1.82	<10 - 100	10	322:498	10	1.65	<10 - 50	12
Nd	40	1.68	46	120:538	36	1.76	<70 - 300	43	109:332	46	1.58	<70 - 300	51
Ni	13	2.31	19	747:778	15	2.10	<5 - 700	19	443:540	11	2.64	<5 - 700	18
P	260	2.67	430	524:524	320	2.33	40 - 4,500	460	380:382	200	2.95	<20 - 6,800	360
Pb	16	1.86	19	712:778	17	1.80	<10 - 700	20	422:541	14	1.95	<10 - 300	17
Rb	58	1.72	67	221:224	69	1.50	<20 - 210	74	107:131	43	1.94	<20 - 160	53
S, percent	.12	2.04	.16	34:224	.13	2.37	<0.08 - 4.8	.19	20:131	.10	1.34	<0.08 - 0.31	.11
Sb	.48	2.27	.67	35:223	.47	2.15	<1 - 2.6	.62	31:131	.52	2.38	<1 - 8.8	.76
Sc	7.5	1.82	8.9	685:778	8.2	1.74	<5 - 50	9.6	389:526	6.5	1.90	<5 - 30	8.0
Se	.26	2.46	.39	590:733	.23	2.43	<0.1 - 4.3	.34	449:534	.30	2.44	<0.1 - 3.9	.45
Si, percent[1]	31	6.48	None	250:250	30	5.70	15 - 44	None	156:156	34	6.64	1.7 - 45	—
Sn	.89	2.36	1.3	218:224	.90	2.11	<0.1 - 7.4	1.2	123:131	.86	2.81	<0.1 - 10	1.5
Sr	120	3.30	240	778:778	200	2.16	10 - 3,000	270	501:540	53	3.61	<5 - 700	120
Ti, percent	.24	1.89	.29	777:777	.22	1.78	0.05 - 2.0	.26	540:540	.28	2.00	0.007 - 1.5	.35
Th	8.6	1.53	9.4	195:195	9.1	1.49	2.4 - 31	9.8	102:102	7.7	1.58	2.2 - 23	8.6
U	2.3	1.73	2.7	224:224	2.5	1.45	0.68 - 7.9	2.7	130:130	2.1	2.12	0.29 - 11	2.7
V	58	2.25	80	778:778	70	1.95	7 - 500	88	516:541	43	2.51	<7 - 300	66
Y	21	1.78	25	759:778	22	1.66	<10 - 150	25	477:541	20	1.97	<10 - 200	25
Yb	2.6	1.79	3.1	754:764	2.6	1.63	<1 - 20	3.0	452:486	2.6	2.06	<1 - 50	3.3
Zn	48	1.95	60	766:766	55	1.79	10 - 2,100	65	473:482	40	2.11	<5 - 2,900	52
Zr	180	1.91	230	777:778	160	1.77	<20 - 1,500	190	539:541	220	2.01	<20 - 2,000	290

[1]Means are arithmetic, deviations are standard.

EnviroGard™ Field Soil Extraction Kit II

ENSP 000 20

For use with the EnviroGard PCB Test Kit. For laboratory and on-site analysis of soil.

Intended Use

The EnviroGard PCB Field Soil Extraction Kit II is used for extracting polychlorinated bi-phenyls (PCBs) and/or pesticides from soil samples, prior to analysis. The EnviroGard Field Soil Extraction Kit II devices have been qualified for use with methanol solvent, which is used in the EnviroGard PCB Test Kit Soil Extraction procedure.

Before You Start

The EnviroGard Field Soil Extraction Kit II contains the following components:

12 soil extraction bottles with mixing beads
12 two-piece filter/plunger units
12 prefilter frits
15 weigh boats
15 wood spatulas
12 glass vials (5 mL)

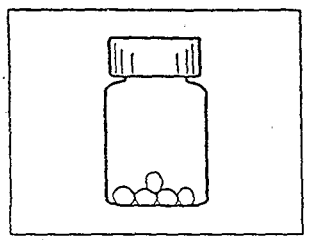
Other Items Needed

- 5 mL of methanol per sample extracted
- pipettes and glass test tubes for diluting high concentration extract (>50 ppm), if a more accurate estimate of these concentrations is desired
- a balance to weigh 5 gram soil samples
- 10 mL glass vials to hold soil extracts

PERFORM SOIL EXTRACTION

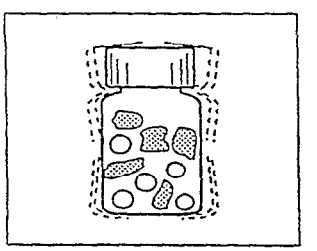
1. Weigh out 5 grams of soil (refer to the application sheet, "*Gravimetric Soil Analysis with the EnviroGard PCB Test Kit*").

2. Add a 5 gram soil sample to the solvent extraction bottle with mixing beads.

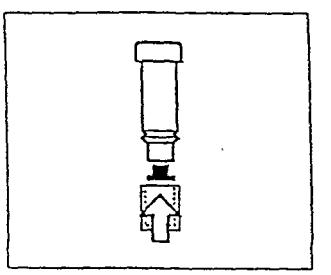


3. Add 5 mL of methanol to the sample in the solvent extraction bottle.

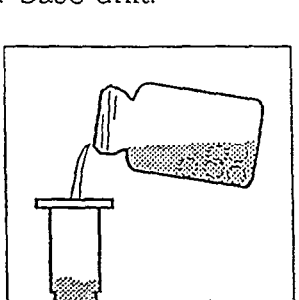
4. Cap and vigorously agitate the bottle for 2 minutes to break up the soil matrix.



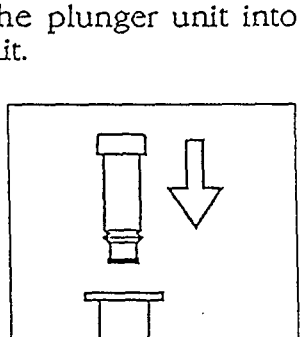
5. Insert the prefilter frit onto the end of the plunger unit. Push the plastic cap onto the filter end of the plunger unit so that it covers the prefilter frit.



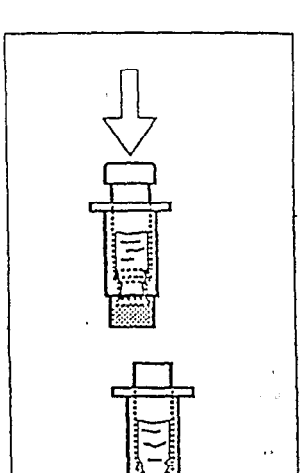
6. To transfer the soil methanol mixture, simply pour off the mixture into the filter base unit.



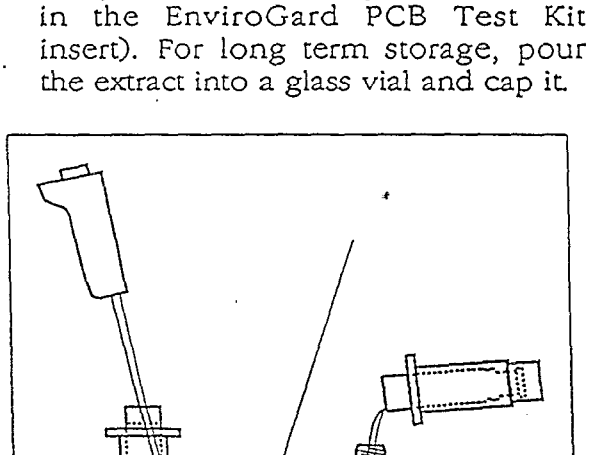
7. Insert the plunger unit into the filter base unit.



8. Press down firmly on the plunger.



9. Uncap the plunger. Using a pipettor, remove the extract for immediate analysis (refer to *"Perform the Test"* in the EnviroGard PCB Test Kit insert). For long term storage, pour the extract into a glass vial and cap it.



TECHNICAL INFORMATION

Ordering Information

Description	Catalogue No.
EnviroGard PCB Test Kit	ENVR 000 09
EnviroGard Field Soil Extraction Kit II, for gravimetric sample handling	ENSP 000 20
Methanol for soil extraction, 100 mL bottle	ELCR 000 07
EnviroGard PCB in Soil Test Kit shipping kit, which includes:	ENVR 000 10

- EnviroGard PCB Test Kit (ENVR 000 09)
- EnviroGard Field Soil Extraction Kit II (ENSP 000 20)
- Methanol, 100 mL (ELCR 000 07)

Technical Assistance

For additional information about Millipore products, telephone toll-free (including Massachusetts): 800-225-1380.
In Western States, Alaska & Hawaii: 800-632-2708
In Canada: 800-268-4881
In Toronto: 416-678-2161
In Puerto Rico: 809-747-8444

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Shanghai: (86-21) 373-7256

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General Limited Warranty

Millipore Corporation ("Millipore") warrants the products manufactured by it against defects in materials and workmanship when used in accordance with the applicable instructions for a period of one year from the date of shipment of the products or where applicable, for a period not to extend beyond a product's printed expiration date. MILLIPORE MAKES NO OTHER WARRANTY, EXPRESSED OR IMPLIED. THERE IS NO WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. The warranty provided herein and the data, specifications and descriptions of Millipore products appearing in Millipore's published catalogues and product literature may not be altered except by express written agreement signed by an officer of Millipore. Representations, oral or written, which are inconsistent with this warranty or such publications are not authorized and if given, should not be relied upon.

In the event of a breach of the foregoing warranty, Millipore's sole obligation shall be to repair or replace, at its option, any product or part thereof that proves defective in materials or workmanship within the warranty period, provided the customer notifies Millipore promptly of any such defect. The exclusive remedy provided herein shall not be deemed to have failed of its essential purpose so long as Millipore is willing to repair or replace any nonconforming Millipore product or part. Millipore shall not be liable for consequential damages resulting from economic loss or property damages sustained by a customer from the use of its products.

However, in some states the purchaser may have rights under state law in addition to those provided by this warranty.

P34305, Rev. -, 6/92

MILLIPORE

EnviroGard™ PCB Test Kit

ENVR 000 09 (with PCB calibrators)
ENVR 0NC 09 (without PCB calibrators)

Read this instruction manual thoroughly before attempting to use this product.

Intended Use

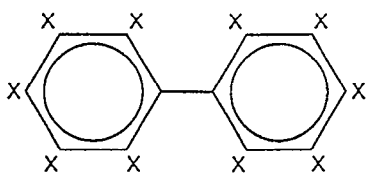
The Millipore EnviroGard PCB Test Kit is an enzyme immunoassay for the detection of a range of polychlorinated biphenyls (PCB) in soil, to include Aroclors 1016, 1242, 1248, 1254, and 1260. The EnviroGard PCB Test Kit allows for reliable and rapid screening for PCB in soils at specified action levels within the following sensitivity ranges:

- 5, 10, 50 part per million (ppm) (standard range)
- 1, 5, 10 ppm (high sensitivity range)

NOTE: If you use the EnviroGard PCB test kit without calibrators (ENVR 0NC 09), modify the directions according to the calibrator or standards in use.

Test Summary and Explanation

PCBs are a family of compounds with the following general structure.



where X = Hydrogen (H) or Chlorine (Cl)

There are 209 individual forms (or congeners) containing from 1–10 chlorine atoms on the biphenyl structure shown. PCBs were originally sold in the U.S.A. under the trade name Aroclor. Each Aroclor is composed of many congeners. Many congeners may occur in more than one Aroclor. Aroclors are differentiated on the basis of average chlorine content (percent chlorine by weight). For Aroclor nomenclature, the last two digits of the four digit label indicate this percentage. For example, Aroclor 1248 is approximately 48% chlorine by weight. The sole exception to this rule, Aroclor 1016, is similar in total chlorine content to Aroclor 1242, but contains a different congener distribution.

NOTE: Refer to the section "Results Interpretation" and "Specificity" for more information on Aroclors.

The EnviroGard PCB Test Kit employs an antibody against PCB that is coated onto 12 X 75 millimeter (mm) polystyrene test tubes. The method is based on the principles of competitive immunoassay, where the absorbance signal (optical density) of the final reaction mixture is inversely proportional to the concentration of analyte (PCB) present in the original sample. A soil sample that generates a signal greater than the signal of the PCB assay calibrator (e.g., 50 ppm) has a 99% probability of containing less PCB than the specified assay calibrator (e.g., < 50 ppm).

Test Principles

PCBs present in soil extracts and assay calibrators are bound during the first incubation by the anti-PCB antibodies, which have been adsorbed onto the test tubes. After you decant the sample and wash test tubes, you add a peroxidase-PCB conjugate.

NOTE: The amount of conjugate bound (by unoccupied anti-PCB antibody binding sites in the test tube) is inversely proportional to the amount of PCB originally present in the sample.

After a 5 minute incubation, you decant unbound conjugate and wash the test tubes again. Finally, you add a solution that contains a chromogenic peroxidase substrate to the test tubes.

NOTE: Color development is directly proportional to enzyme concentration and inversely proportional to PCB concentration in the original sample in the test tubes.

PCB levels in unknown samples are interpreted relative to standard assay calibrator levels (e.g., 1, 5, 10, 50 ppm) or Aroclor standards, using visual comparison or reading by a spectrophotometer.

Precautions

- **Important:** Follow **all precautions** and **all instructions** in this insert carefully to achieve accurate results.
- Treat PCBs, solutions that contain PCBs, and potentially contaminated soil samples as hazardous materials.
- Use gloves, proper protective clothing, and means to contain and handle hazardous material where appropriate.
- Obtain (if appropriate) permits pertaining to the handling, analysis and transport of PCB-containing materials.
- **Storage:**

  Store all test kit components at 4°C to 8°C (39 °F to 46°F) when not in use.

  Storage at ambient temperature (18°C to 27°C or 64°F to 81°F) on the day of use is acceptable. Do not store at ambient temperature for more than 8 hours.

  Do not freeze test kit components or expose them to temperatures greater than 37°C (99°F).
- Allow all reagents to reach ambient temperature (18°C to 27°C or 64°F to 81°F) before beginning the test. This typically requires at least 30 minutes to warm from recommended storage conditions.
- Do not expose **substrate** to **direct sunlight**.
- Do not use test kit components after the expiration date.
- Do not use reagents or test tubes from one test kit with reagents or test tubes from a different test kit.
- Use approved methodologies to confirm any positive results.
- Distribution of PCB in soils may be highly variable and can be minimized through use of a composite sampling technique. Adequate sample number and distribution are the responsibility of the analyst.

Materials Provided

- 20 PCB antibody-coated, 12 mm X 75 mm polystyrene test tubes
- 15 milliliter (mL) Assay Diluent
- 0.5 mL Negative Control (Methanol)
- 5.0 mL PCB-Enzyme Conjugate
- 15 mL Chromogenic Substrate
- 15 mL Stop Solution
- 20-Place test tube rack
- 22 Pre-assembled 1–25 µL Gilson Microman® positive displacement pipette tips, yellow
- 4 PCB positive assay calibrators:

  0.5 mL 1.0 ppm calibrator
  0.5 mL 5.0 ppm calibrator
  0.5 mL 10 ppm calibrator
  0.5 mL 50 ppm calibrator

NOTE: The PCB positive assay calibrators do not reflect the actual PCB (Aroclor) concentrations provided. See "Calibrator Concentrations" for the actual PCB concentrations.

Materials You Supply

See "Ordering Information" for the appropriate catalogue numbers. To order refer to the "Technical Assistance" section for the phone numbers of the nearest Millipore office.

Methanol

Methanol (70 mL for 14 samples) is required for soil extractions.

EnviroGard Soil Extraction Bottle Kit

Use this kit (ENSP 000 30) for the extraction of PCB from soil samples. [Previously, the Soil Extraction Kit (ENSP 000 20) was used.] The Soil Extraction Bottle Kit contains the following items to test 14 samples:

- 14 LDPE bottles with screw caps, 30 mL (each bottle contains 3 stainless steel mixing beads)
- 14 Filtration caps, comprised of 14 Luer-tipped caps with frits and 14 Millex® filters
- 1 20 mL syringe with attached bottle coupler
- 1 extra syringe-to-bottle coupler
- 18 Wooden spatulas
- 14 Screw top glass storage vials, 4 mL
- 18 Weigh boats
- 14 Luer plugs

EnviroGard Soil Field Lab
(Starter Accessory Kit)

This kit contains the following items:

- 1 Positive displacement precision pipettor, adjustable (2-250 microliters [µL])
- 1 Eppendorf™ Repeater® pipettor
- 1 Electronic timer
- 13 Polystyrene test tubes, 12 mm X 75 mm (for blanking the spectrophotometer and dilutions)
- 1 Portable balance with a 100 gram (g) calibrator weight
- 1 Wash bottle, 500 mL
- 4 Six-position test tube racks
- 100 1–25 µL Positive displacement pipette tips (yellow), non-preassembled
- 100 50–250 µL Positive displacement pipette tips (pink), non-preassembled
- 8 5.0 mL Pipette tips for the Repeater pipettor, (for 0.1 mL to 0.5 mL dispensing volumes)
- 4 12.5 mL Pipette tips for the Repeater pipettor, (for 0.25 mL to 1.250 mL dispensing volumes)
- 1 50 mL Pipette tip for the Repeater pipettor (for 1.0 mL to 5.0 mL dispensing volumes)

NOTE: Order replacement pipettors and tips separately. See the "Ordering Information" section.

Millipore Differential Photometer

The Millipore Differential Photometer allows you to measure results in the form of optical density values. These values can be used for objective record keeping, quality assurance, or quantitative determination of sample concentrations from an Aroclor standard curve. See "Ordering Information" for the catalogue number.

Other

- Tap or distilled water for washing test tubes

Materials Suggested but Not Required

- Protective clothing (e.g., latex gloves)
- Absorbent paper for blotting test tubes
- Liquid and solid waste containers

Assay Procedure

Collect/Store the Sample

The following steps explain how to properly collect and store your samples.

1. Collect soil in appropriately-sized and labeled containers.

NOTE: Take care to remove excess twigs, organic matter, and rocks or pebbles from the soil sample to be tested.

2. Soils obtained from areas adjacent to standing water, surface soils collected during or immediately after rain or snow, or any soils with relatively high amounts of water (≥ 30% by weight) should be dried before testing..

NOTE: Contact technical service for recommended methods.

3. Storage of soil samples should follow the holding conditions recommended for EPA method 8080 (GC analysis of PCBs in soil) which is up to 14 days at 4°C (39°F).

Prepare the Sample/Extract the Soil

1. Please follow the instructions from the EnviroGard Soil Extraction Bottle Kit to prepare the soil extract before the assay.
2. **5 ml** of **Methanol** will be used to extract PCB residue from a 5 gram soil sample. As per instructions, attach a **50 mL** Combitip to the Repeater pipettor and set the dial to **5**. Deliver once to add **5 mL** of **methanol** to the extraction vial, and cap tightly.

NOTE: When extracting clay samples, it is possible that the sample will soak up all of the methanol, leaving little or no excess liquid to filter. You should add an additional 5.0 mL of methanol to the sample and shake vigorously for an additional 1–2 minutes. Make sure to factor the dilution into the calculations. See the "Results Interpretation" section.

Perform the Test

The PCB Test Kit can be performed in either of the two following ranges:

Standard Protocol	High Sensitivity Protocol
For PCB analyses in the 5.0-50 ppm range, use a 5.0 microliter (µL) volume sample and the appropriate calibrators (5, 10, 50 ppm).	For PCB analyses in the 1.0-10 ppm range, use a 25 µL volume sample and the appropriate calibrators (1, 5, 10 ppm).

NOTE: Allow all reagents to reach ambient temperature (18°C to 27°C or 64°F to 81°F) before beginning the test. This typically requires at least 30 minutes to warm from recommended storage conditions.

Follow the appropriate steps and calibrators for your protocol.

1. Label the 12 mm X 75 mm test tubes (no more than 20 tubes/assay). You do not have to perform the assay in duplicate; however, doing so increases the precision of the test.

Standard Protocol		High Sensitivity Protocol	
Tube Label	**Tube Contents**	**Tube Label**	**Tube Contents**
NC	Negative Control	NC	Negative Control
5 ppm	5 ppm PCB calibrator	1 ppm	1 ppm PCB calibrator
10 ppm	10 ppm PCB calibrator	5 ppm	5 ppm PCB calibrator
50 ppm	50 ppm PCB calibrator	10 ppm	10 ppm PCB calibrator
S1	Sample 1	S1	Sample 1
S2	Sample 2	S2	Sample 2

NOTE: To maximize efficiency of kit use, include only those calibrator levels at which decisions will be made. The negative control is an optional control for assay quality control purposes.

2. Place the test tubes in the test tube rack, pressing down firmly on each tube so that they are held securely.

CAUTION: Do not "snap" the test tubes into the rack as this may result in a cracked tube.

3. Position the Repeater pipettor at Setting **2** and use the **12.5 mL** syringe to add **500** µL of Assay Diluent to all test tubes.

4. Attach a clean yellow pipette tip to the positive displacement pipet and adjust the dial to **"250"** to pipet 25 µL or **"050"** to pipet 5 µL.

5. Use the positive displacement pipettor, to add the Negative Control (methanol) and the appropriate calibrators and sample extracts to the corresponding test tubes as follows:

Standard Protocol		High Sensitivity Protocol	
Tube Contents	**Volume Added**	**Tube Contents**	**Volume Added**
Neg. Control	5 µL	Neg. Control	25 µL
5 ppm	5 µL	1 ppm	25 µL
10 ppm	5 µL	5 ppm	25 µL
50 ppm	5 µL	10 ppm	25 µL
Samples	5 µL	Samples	25 µL

CAUTION: Replace the cap(s) on the calibrator vials immediately after use to minimize evaporation.

6. **Important - briefly shake** the test tube rack to **mix well;** then incubate for 15 minutes.

7. Vigorously shake out the test tube contents into a sink or suitable container. Fill the test tubes to overflowing with cool tap or distilled water, then decant and vigorously shake out the remaining water.

8. Repeat this wash step three more times, being certain to shake out as much water as possible on each wash. After the final wash, remove as much water as possible by tapping the inverted tubes on absorbent paper.

9. Position the Repeater pipettor at Setting **2** and use the **5 mL** syringe to add 200 µL of the PCB enzyme-conjugate to all test tubes. **Important - briefly shake** the test tube rack to **mix well;** then incubate for 5 minutes.

10. Vigorously shake out the test tube contents into a sink or suitable container. Fill the test tubes to

overflowing with cool tap or distilled water, then decant and vigorously shake out the remaining water.

11. Repeat this wash step three more times, being certain to shake out as much water as possible on each wash. After the final wash, remove as much water as possible by tapping the inverted tubes on absorbent paper.

12. Position the Repeater pipettor at Setting **2** and use a clean **12.5 mL** syringe to add 500 µL of Substrate to all test tubes. **Important - briefly shake** the test tube rack to **mix well**, then incubate for 5 minutes.

13. Position the Repeater pipettor at Setting **2** and use a **12.5 mL** syringe to add 500 µL of Stop Solution to all test tubes.

    ▲ **WARNING: Stop solution is 1.0 N hydrochloric acid. Handle carefully.**

14. Add 1.0 mL of Stop Solution to the blank test tube and insert the tube into the left well of the spectrophotometer. Dry the outside of each assay tube and measure the absorbance [optical density (OD)] by placing each tube into the right well of the spectrophotometer. Record the absorbance of each tube.

    NOTE: For more details refer to the Millipore Differential Photometer instructions (P17500). See the "References" section of this insert.

Results Interpretation

For Aroclors 1242, 1016, 1248, and 1254, the confidence interval given below for negative samples (i.e. ≤ 1 ppm, ≤ 5 ppm, ≤ 10 ppm, and ≤ 50 ppm) exceeds 99%. For Aroclor 1260 the confidence interval is smaller, but still exceeds 95%.

- Samples with OD_{450} values > OD_{450} of the 1.0 ppm PCB calibrator contain *less* than 1.0 ppm PCB.

  Samples with OD_{450} values ≤ OD_{450} of the 1.0 ppm PCB calibrator may contain *more* than 1.0 ppm PCB.

- Samples with OD_{450} values > OD_{450} of the 5 ppm calibrator contain *less* than 5 ppm PCB.

  Samples with OD_{450} values ≤ OD_{450} of the 5 ppm calibrator *may* contain *more* than 5 ppm PCB.

- Samples with OD_{450} values > OD_{450} of the 10 ppm calibrator contain *less* than 10 ppm PCB.

  Samples with OD_{450} values ≤ OD_{450} of the 10 ppm calibrator *may* contain *more* than 10 ppm PCB.

- Samples with OD_{450} values > OD_{450} of the 50 ppm calibrator contain *less* than 50 ppm PCB.

  Samples with OD_{450} values ≤ OD_{450} of the 50 ppm calibrator *may* contain *more* than 50 ppm PCB.

Soil samples that were extracted with more than 1.0 mL of methanol per gram of soil (e.g., for clay samples) require a correction factor to interpret the results. Multiply each of the calibrator concentrations by the ratio of methanol (mL) to soil (grams).

Example

If a 5.0 g soil sample is extracted with 10 mL of methanol, then the ratio of methanol to soil is "2" (10/5). The calibrator levels used for this soil would change to 10 ppm, 20 ppm, and 100 ppm (2 x 5 ppm, 2 x 10 ppm, and 2 x 50 ppm).

Analysis of Other Aroclors

It is possible to analyze other Aroclors not previously described in this insert, including Aroclors 1221, 1232, 1262, and 1268. Sensitivities and confidence intervals may be different for each of these. Any such analysis would require calibration with the matching Aroclor.

For more information, refer to the section, "Technical Assistance" for the number of the nearest Millipore office.

Performance Characteristics

Sensitivity

The sensitivity is sufficient to perform the test at each calibrator level with 99% confidence. The minimum reliable detection limit for the EnviroGard PCB Test Kit is 3.3 ppm in soil for the standard protocol and 0.5 ppm in soil for the high sensitivity protocol. This is the lowest concentration of PCB in soil that is differentiated 99% of the time from zero. The sensitivity of the assay also depends on the specific Aroclor that is measured. Continue on to the "Specificity" section.

Specificity

The PCB antibody in this kit binds to different Aroclors with different affinities. The test specificity is restricted to PCBs. The test response to Aroclors 1016, 1242, 1254, and 1260 is within twofold of the response for Aroclor 1248. The calibrator levels are

adjusted to detect the specified Aroclors with 95% confidence that there will be no false negatives.

Interfering Substances

The following substances were tested and found to have less than 0.5% weight-to-weight of the immunoreactivity of Aroclor 1248.

1,2-dichlorobenzene
1,3-dichlorobenzene
1,4-dichlorobenzene
1,2,4-trichlorobenzene
2,4-dichlorophenol
2,5-dichlorophenol
2,4,5-trichlorophenol
2,4,6-trichlorophenol
biphenyl
pentachlorophenol (PCP)

Limitations of the Procedure

The EnviroGard PCB Test Kit is a screening test *only*. Actual quantitation of PCBs by EnviroGard immunoassay is only possible if the contaminating Aroclor is known and if the assay is standardized using that Aroclor.

Soil sampling error may significantly affect testing reliability. The distribution of PCBs in different soils can be extremely heterogeneous. Soils should be homogenized thoroughly before analysis by any method. Split samples (e.g., for GC and immunoassay) should always come from the same homogenate.

To ensure accurate and reliable results, every effort should be made to perform the EnviroGard PCB Test at temperatures between 15°C (59°F) and 30°C (86°F).

Expected Values for PCB-Contaminated Soils

Contaminated soils have PCB levels that correlate well (correlation coefficient [r] ~ 0.9) with GC values. The slope of the regression line will depend on the contaminating Aroclor. Aroclor 1248-contaminated samples have a slope close to "1" since the EnviroGard PCB Test Kit is standardized using Aroclor 1248.

CAUTION: The standard and high sensitivity assay ranges require the use of different sample and calibrator volumes. The sensitivity of the standard protocol is insufficient for analysis at 1 ppm, while the high sensitivity protocol is too sensitive for analysis at 50 ppm. Use the standard protocol (5 µL sample and calibrator volumes) when analyzing in the 5 to 50 ppm range. Use the high sensitivity protocol (25 µL sample and calibrator volumes) when analyzing in the 1 to 10 ppm range. If analysis is performed only at 5 and/or 10 ppm, use the high sensitivity protocol for best pipetting performance. *Always use the same volume for all samples and calibrators within one assay.*

Calibrator Concentrations

Calibrator Action Level	Calibrator Actual Concentration
1.0 ppm calibrator	0.5 ppm Aroclor 1248
5 ppm calibrator	3.0 ppm Aroclor 1248
10 ppm calibrator	5 ppm Aroclor 1248
50 ppm calibrator	22.0 ppm Aroclor 1248

Quality Control

If a blue color does not develop in the negative control test tube within 5 minutes after adding the substrate solution, the test is invalid and must be repeated.

References

Data related to the EnviroGard PCB Test Kit is on file at Millipore Corporation. Refer to the section, "Technical Assistance," for the phone number of the nearest Millipore office.

95%

Ordering Information

The following table lists descriptions and catalogue numbers for various EnviroGard PCB and soil extraction test kits and related products.

Description	Catalogue Number
EnviroGard PCB Test Kit	ENVR 000 09
EnviroGard PCB in Soil Test Kit, shipping kit includes: ■ EnviroGard PCB Test Kit (ENVR 000 09) ■ EnviroGard Soil Extraction Bottle Kit (ENSP 000 30) ■ Methanol, 100 mL (ELCR 000 07)	ENVR 000 10
Methanol for soil extraction, 100 mL bottle	ELCR 000 07
EnviroGard Soil Field Lab includes: ■ 1 Positive displacement precision pipettor, adjustable (2-250 µL) ■ 1 Eppendorf Repeater pipettor ■ 1 Electronic timer ■ 13 Polystyrene test tubes, 12 mm X 75 mm (for blanking the spectrophotometer and dilutions) ■ 1 Portable balance with a 100 gram calibrator weight ■ 1 Wash bottle, 500 mL ■ 4 Test tube racks, six-position ■ 100 1–25 µL Positive displacement pipette tips (yellow), non-preassembled ■ 100 50-250 µL Positive displacement pipette tips (pink), non-preassembled ■ 8 5.0 mL Pipette tips for the Repeater pipettor, (for 0.1 mL to 0.5 mL dispensing volumes) ■ 4 12.5 mL Pipette tips for the Repeater pipettor, (for 0.25 mL to 1.25 mL dispensing volumes) ■ 1 50 mL Pipette tip for the Repeater pipettor (for 1.0 mL to 5.0 mL dispensing volumes)	ENVR L00 09
Millipore Differential Photometer: ■ 115 volt (V) ■ 230 V	 ENVR 000 00 ENVR 002 30
EnviroGard Replacement Pipettor Tips (available separately): ■ Positive displacement pipettor tips, 1.0-25 µL, 200 pack, non-preassembled ■ Positive displacement pipettor tips, 50-250 µL, 200 pack, non-preassembled ■ Repeater pipettor tips, 5.0 mL, 100/pk ■ Repeater pipettor tips, 12.5 mL, 100/pk ■ Repeater pipettor tips, 50 mL, 10/pk	 ENVR L04 09 ENVR L07 09 ENVR L01 09 ENVR L02 09 ENVR L03 09
EnviroGard PCB Test Kit (without PCB calibrators)	ENVR 0NC 09

Technical Assistance

For additional information about Millipore products, call the nearest Millipore office listed below.

Call toll-free 800-MILLIPORE (800-645-5476) **FAX Orders 508-624-8873**

Millipore Worldwide:

Australia
A•C•N: (001) 239-818
Toll Free (008) 222-111
In Sydney Area (02) 428-7333

Austria, Central Europe, C.I.S., Africa, Middle-East, and Gulf
In Austria: (43) 1-877-8926

Baltic Republics
In Finland: (90) 801 90 77

Belgium and Luxembourg
(02) 242-17-40

Brazil
Tel. (011) 548-7011

Canada
Toll Free 1-800-268-4881
In Toronto Area:
416-678-2161

China, People's Republic of
Beijing: (86) 1-5135114
Guangzhou: (86) 20-686217
Shanghai: (86) 21-3203856

Czech Republic
Tel. (42) 2-35-02-27
(42) 2-35-23-75

Denmark
Tel. (46) 59-00-23

Finland
Tel. (90) 8045110

France
Tel. (1) 30-12-70-00

Germany
Tel. (06196) 494-0

Hong Kong
Tel. (852) 803-9111

Hungary
Tel. (36) 11-66-86-74

India
Bangalore:
Tel. (812) 394657

Italy
Milano: (02) 25078-1
Roma: (06) 5203600
Padova: (049) 8803720

Japan
Tel. (03) 3474-9111

Korea
Tel. (82-2) 5548305

Malaysia
Tel. (60) 3-7571322

Mexico
Tel. (525) 576-96-88

The Netherlands
Tel. (01608) 22000

Norway
Tel. 472- 267-82-53

Poland
Tel. (48) 2-669-12-25
(48) 2-663-70-31

Puerto Rico
Tel. (809) 747-8444

Singapore
Tel. (65) 253-2733

Spain
Madrid: 91-729-03-00
Barcelona: 93-325-96-16
Sevilla: 95-425-68-77

Sweden
Sundbyberg:
08-628-69-60

Switzerland
Tel. (01) 945-3242

Taiwan
Tel. (886-2) 7001742

United Kingdom and Ireland
Tel. (0923) 816375

United States of America
Tel. Toll Free
800-MILLIPORE
(800-645-5476)
In Puerto Rico:
(809) 747-8444

In All Other Countries:

Millipore Intertech, U.S.A.
397 Williams Street
Marlborough, MA
01752-9162 U.S.A.
Tel. (508) 624-8622
Fax (508) 624-8630

Safety

To receive complete safety information on this product, contact the nearest Millipore office and request Material Safety Data Sheet documents P34207, P34210, P34782, and P70002.

General Limited Warranty

Millipore Corporation ("Millipore") warrants the products manufactured by it against defects in materials and workmanship when used in accordance with the applicable instructions for a period of one year from the date of shipment of the products. Or where applicable, for a period not to extend beyond a product's printed expiration date. **MILLIPORE MAKES NO OTHER WARRANTY, EXPRESSED OR IMPLIED. THERE IS NO WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.** The warranty provided herein and the data, specifications and descriptions of Millipore products appearing in Millipore's published catalogues and product literature may not be altered except by express written agreement signed by an officer of Millipore. Representations, oral or written, which are inconsistent with this warranty or such publications are not authorized and if given, should not be relied upon.

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P31807, Rev. B, 5/6/94

EPA Region III

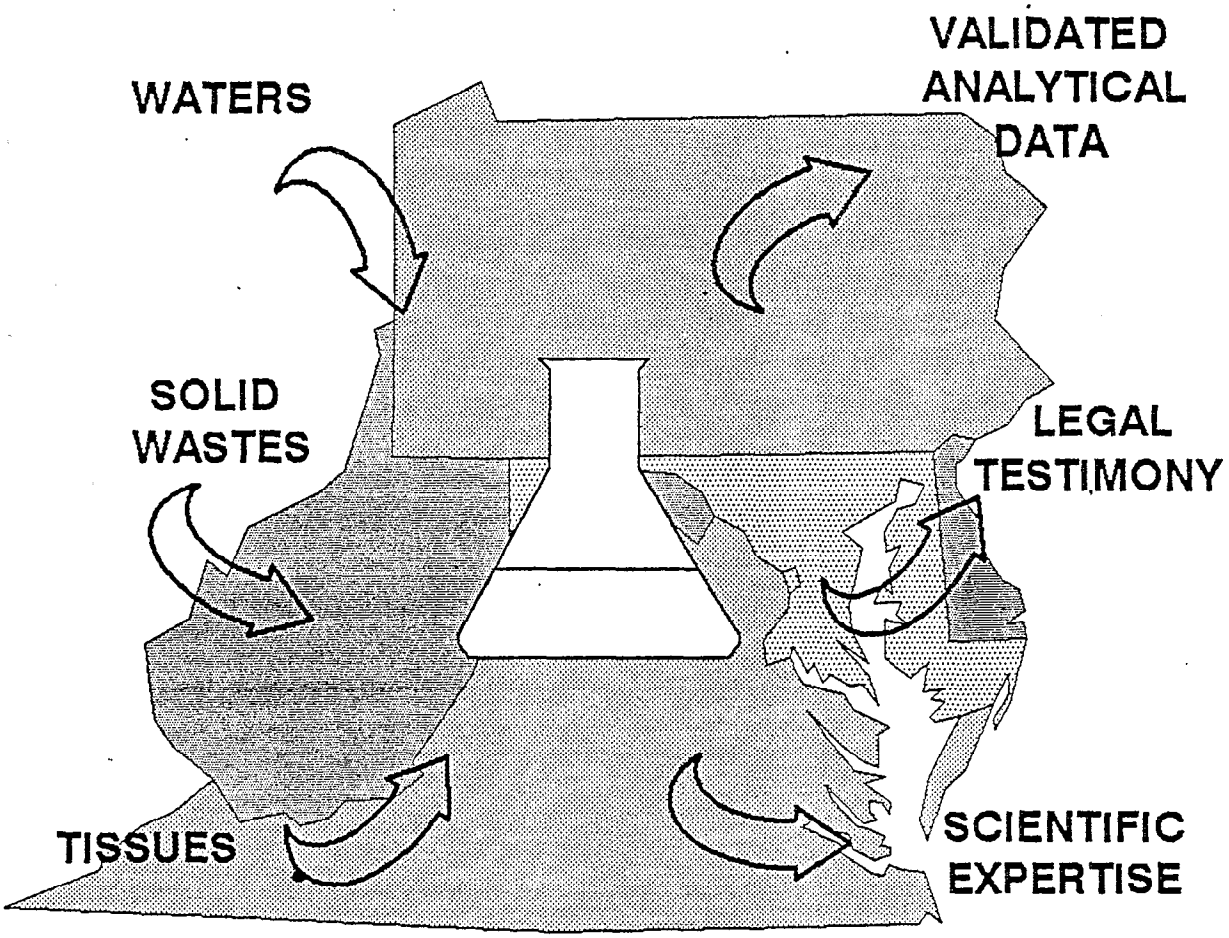
Central Regional Laboratory

YORKTOWN NAVAL WEAPONS

SUPERFUND F/F ACCT. NO. TYP03N47N

REQ 94088

JULY 25, 1994



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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
CENTRAL REGIONAL LABORATORY
839 BESTGATE ROAD
ANNAPOLIS, MARYLAND 21401-3013
(410) 573-2799

DATE: July 25, 1994

SUBJECT: Analytical Results for Yorktown Naval Weapons (REQ 94088)

FROM: Frederick Dreisch, Chief (3ES20) FD
Laboratory Branch

TO: Robert G. Thomson, Jr. (3HW71)

Attached are the analytical results for PCB/pesticides, volatile organic compounds, GC/MS extractables, metals, mercury and percent dry weight determinations of the Yorktown Naval Weapons site samples submitted to the Central Regional Laboratory on June 2, 1994.

The report is organized into several sections:

Section A. Sample Description (listing of laboratory sample numbers and an abbreviated description of the tests performed).

Section B. Analytical Results (listing of the analytical results for the samples, as well as the following QC results : organic surrogate recoveries). The analytical results have been reviewed by a second analyst and laboratory managers.

Section C. Target Compound/Analyte Lists and Nominal Quantitation Limits (listing of the lowest concentration level at which analytical results are accurately quantitated. The Actual Quantitation Limits (AQL) achieved for a given sample are a function of matrix interferences and procedural steps, e.g., exact weight of sample analyzed. Specific information for the calculation of AQLs is included in Section E).

Section D. Qualifier Codes (listing of the codes used to append additional information about analytical results).

Section E. Method Description and Quality Control Protocols (listing of specific analytical methods, procedural options and quality control procedures. The target limits for the recovery of surrogate spikes (organic) are also included in this Section).

If you have any questions or comments, please call me at (410) 573-2646, or Khin Cho Thaung, Chief, Inorganic Section (410) 573-2680 or Skip Weisberg, Chief, Organic Section (410) 573-2681.

cc: Leif Rowles (Black & Veech)

U.S. EPA Region III
Central Regional Laboratory
Annapolis, Md. 21401
07/25/94

Section: A

Batch ID. REQ94088	Facility: YORKTOWN NAVAL WEAPONS
Account No. TYP03N47N	Program: SUPERFUND F/F

Sample #	Station & Description	Matrix	Collection Dates Beginning	Ending
94060201	STA 16-02, EPA-SS-16-01	Bottom Sediment or Depositi	05/31/94	05/31/94
94060202	STA 16-03, EPA-SS-16-02	Bottom Sediment or Depositi	05/31/94	05/31/94
94060203	STA 16-04, EPA-SS-16-03	Bottom Sediment or Depositi	05/31/94	05/31/94
94060204	STA 16-05, EPA-SS-16-04	Bottom Sediment or Depositi	05/31/94	05/31/94
94060205	STA 16-06, EPA-SS-16-05	Bottom Sediment or Depositi	05/31/94	05/31/94
94060206	STA 16-01, TB-16-01	Other Aqueous Matrices - Ty	05/31/94	05/31/94

Passed Analyst Data Review.

Reviews: 7/25/94 7/25/94 8/2/94
Inorg. Sec. Chief Date Organ. Sec. Chief Date QCO Date

Laboratory Branch Chief Approval For Release: 8/3/94
Date

Sample	Test	Description
94060201	BNA-SOIL	GC/MS Analysis for Semivolatile Organics
	MERCURY-S	Mercury by Semi-Automated Cold Vapor Technique
	METALS-S	Metals Analysis
	PCB/PEST S	PCBs and Pesticides by Gas Chromatography
	PD105	Percent Dry Weight at 105 degree C
	PD60	Percent Dry Weight at 60 degree C
	VOA46.1	Volatile Organic Compounds by Purge & Trap GC/MS
94060202	BNA-SOIL	GC/MS Analysis for Semivolatile Organics
	MERCURY-S	Mercury by Semi-Automated Cold Vapor Technique
	METALS-S	Metals Analysis
	PCB/PEST S	PCBs and Pesticides by Gas Chromatography
	PD105	Percent Dry Weight at 105 degree C
	PD60	Percent Dry Weight at 60 degree C
	VOA46.1	Volatile Organic Compounds by Purge & Trap GC/MS
94060203	BNA-SOIL	GC/MS Analysis for Semivolatile Organics
	MERCURY-S	Mercury by Semi-Automated Cold Vapor Technique
	METALS-S	Metals Analysis
	PCB/PEST S	PCBs and Pesticides by Gas Chromatography
	PD105	Percent Dry Weight at 105 degree C
	PD60	Percent Dry Weight at 60 degree C
	VOA46.1	Volatile Organic Compounds by Purge & Trap GC/MS
94060204	BNA-SOIL	GC/MS Analysis for Semivolatile Organics
	MERCURY-S	Mercury by Semi-Automated Cold Vapor Technique
	METALS-S	Metals Analysis
	PCB/PEST S	PCBs and Pesticides by Gas Chromatography
	PD105	Percent Dry Weight at 105 degree C
	PD60	Percent Dry Weight at 60 degree C
	VOA46.1	Volatile Organic Compounds by Purge & Trap GC/MS
94060205	BNA-SOIL	GC/MS Analysis for Semivolatile Organics
	MERCURY-S	Mercury by Semi-Automated Cold Vapor Technique
	METALS-S	Metals Analysis
	PCB/PEST S	PCBs and Pesticides by Gas Chromatography
	PD105	Percent Dry Weight at 105 degree C
	PD60	Percent Dry Weight at 60 degree C
	VOA46.1	Volatile Organic Compounds by Purge & Trap GC/MS
94060206	VOA45.2	Volatile Organic Compounds by Purge and Trap GC/MS

Batch ID. REQ94088 Facility: YORKTOWN NAVAL WEAPONS
Passed analyst data review

Analyte:	CAS Number:	Units:	Sample Number:					
			94060201 SAM	94060202 SAM	94060203 SAM	94060204 SAM	94060205 SAM	94060206 TRP
>Service Group: BNA								
2,4-Dinitrophenol	51-28-5	mg/Kg	UJ	UJ	UJ	UJ	UJ	
Benzo(a)Anthracene	56-55-3	mg/Kg					0.1 J	
Benzo(a)Pyrene	50-32-8	mg/Kg					0.1 J	
Benzo(B)Fluoranthene	205-99-2	mg/Kg					0.1 J	
Benzo(g,h,i)Perylene	191-24-2	mg/Kg					0.08 J	
Benzo(k)Fluoranthene	207-08-9	mg/Kg					0.1 J	
Benzoic Acid	65-85-0	mg/Kg	UJ	UJ	0.3 J	UJ	UJ	
Bis(2-Ethylhexyl)Phthalate	117-81-7	mg/Kg		0.05 J	0.07 J	0.4 J	0.1 J	
Chrysene	218-01-9	mg/Kg					0.1 J	
Di-n-Octylphthalate	117-84-0	mg/Kg				0.07 J		
Fluoranthene	206-44-0	mg/Kg					0.2 J	
Indeno(1,2,3-cd)Pyrene	193-39-5	mg/Kg					0.07 J	
Phenanthrene	85-01-8	mg/Kg					0.1 J	
Phenol	108-95-2	mg/Kg	0.06 J					
Pyrene	129-00-0	mg/Kg					0.3 J	
2,4,6-Tribromophenol (Surrogate)		% REC	62	68	48	80	56	
2-Fluoro-1,1'-Biphenyl (Surrogate		% REC	71	77	76	78	83	
2-Fluorophenol (Surrogate)		% REC	47	51	52	53	55	
d14-Terphenyl (Surrogate)		% REC	68	71	73	72	80	
d5-Nitrobenzene (Surrogate)		% REC	60	62	63	66	73	
d5-Phenol (Surrogate)		% REC	55	57	53	59	60	
>Service Group: IN-PHYSICAL								
Percent Dry Weight (105C)		%	75.7	90.1	76.7	85.5	93.8	
Percent Dry Weight (60C)		%	79.8	88.5	75.7	86.8	89.8	
>Service Group: METALS								

Batch ID. REQ94088 Facility: YORKTOWN NAVAL WEAPONS
Passed analyst data review

Analyte:	CAS Number:	Units:	Sample Number:					
			94060201 SAM	94060202 SAM	94060203 SAM	94060204 SAM	94060205 SAM	94060206 TRP
Aluminum	7429-90-5	ug/g	10800	3890	7350	10700	7380	
Antimony	7440-36-0	ug/g	<0.5 D	<0.5	0.6	<0.5	1.7	
Arsenic	7440-38-2	ug/g	4.0	0.9	4.5	4.9	3.0	
Barium	7440-39-3	ug/g	31.8	47.5	85.0	28.8	67.9	
Beryllium	7440-41-7	ug/g	<0.5 D	<0.5	0.6	<0.5	<0.5	
Cadmium	7440-43-9	ug/g	<0.5 D	<0.5	2.1	<0.5	30.6	
Calcium	7440-70-2	ug/g	675	17100	1950	214	1450	
Chromium	7440-47-3	ug/g	17.6	5.8	31.6	22.7	72.9	
Cobalt	7440-48-4	ug/g	<5.0 D	<5.0	5.8	<5.0	6.3	
Copper	7440-58-8	ug/g	3.0	257	29.9	5.2	352	
Iron	7439-89-6	ug/g	14300	7930	33200	22000	23700	
Lead	7439-92-1	ug/g	13.1	16.7	67.3	53.4	289	
Magnesium	7439-95-4	ug/g	503	334	886	875	680	
Manganese	7439-96-5	ug/g	29.2	110	484	50.2	284	
Mercury	7439-97-6	ug/g	< 0.1	< 0.1 D	0.1	< 0.1	1.5	
Nickel	7440-02-0	ug/g	<4.0 D	4.4	13.6	4.6	19.5	
Potassium	7440-09-7	ug/g	653	300	780	1120	404	
Selenium	7782-49-2	ug/g	0.4	<0.2	<0.2	<0.2	<0.2	
Silver	7440-22-4	ug/g	<1.0 D	<1.0	<2.0	<1.0	<1.0	
Sodium	7440-23-5	ug/g	<200 D	<200	<200	<200	<200	
Thallium	7440-28-0	ug/g	<0.5 D	<0.5	<0.5	<0.5	<0.5	
Vanadium	7440-62-2	ug/g	30.4	20.1	25.2	33.5	22.0	
Zinc	7440-66-6	ug/g	26.6	391	164	22.4	916	
>Service Group: ORGANICS								
4,4'-DDD	72-54-8	mg/Kg		0.0034	0.14		0.035 C	
4,4'-DDE	72-55-9	mg/Kg		0.0036	0.26		0.029 C	
4,4'-DDT	50-29-3	mg/Kg		0.011 J	0.36 J		0.071 C	
Aldrin	309-00-2	mg/Kg		0.0037				

Batch ID. REQ94088 Facility: YORKTOWN NAVAL WEAPONS
Passed analyst data review

Analyte:	CAS Number:	Units:	Sample Number:					
			94060201 SAM	94060202 SAM	94060203 SAM	94060204 SAM	94060205 SAM	94060206 TRP
Alpha BHC	319-84-6	mg/Kg		0.0041				
Alpha Chlordane	5103-71-9	mg/Kg					0.039 C	
Aroclor 1254	11097-69-1	mg/Kg					1.4	
Aroclor 1260	11096-82-5	mg/Kg					3.0	
Dieldrin	60-57-1	mg/Kg		0.058 J			0.041 C	
Endosulfan-II	959-98-8	mg/Kg					0.037 C	
Endrin	72-20-8	mg/Kg					0.090 C	
Endrin Aldehyde	7421-93-4	mg/Kg					0.053 C	
Endrin Ketone	53494-70-5	mg/Kg		0.0054				
Decachlorobiphenyl (Surrogate)	877-09-8	% REC	108	104	TD	106	142	
Tetrachloro-M-Xylene (Surrogate)	877-09-8S	% REC	84	83	72	88	66	
>Service Group: VOA								
1,1,2,2-Tetrachloroethane	79-34-5	ug/Kg			0.9 J			
1,2,3-Trichloropropane	96-18-4	ug/Kg			1 J			
1,2-Dichloroethane	107-06-2	ug/L						2 J
2-Butanone	78-93-3	ug/L						5 J
Acetone	67-64-1	ug/Kg	6 B	7 B		4 B		
Acetone	67-64-1	ug/L						15 B
Methylene Chloride	75-09-2	ug/Kg	3 B				4 B	
Methylene Chloride	75-09-2	ug/L						0.6 B
Naphthalene	91-20-3	ug/Kg			2 J			
Bromofluorobenzene (Surrogate)	460-00-4	% REC	90	93	92	92	93	98
d4-1,2-Dichloroethane (Surrogate)	17060070	% REC	105	106	104	103	103	100
d8-Toluene (Surrogate)	2037265	% REC	98	101	100	96	97	95

EPA Region III
Central Regional Laboratory
Inorganics
Nominal Quantitation Limits and Test Names

INORGANICS

Name	Aqueous Test Name	Aqueous NQL	Aqueous Unit	Solids Test Name	Solids NQL	Solids Unit
Acidity	ACDTY	4	mg/L			
Alkalinity	ALK01	2	mg/L			
Ammonia	NH301	0.04	mg/L			
Biological Oxygen Demand	BOD05	1	mg/L			
Bromide	BR001	0.5	mg/L			
Chloride	CL001	0.2	mg/L			
Color	COLOR	5	True Color Units			
Chemical Oxygen Demand	COD01	4	mg/L			
Cyanide	CN001	0.012	mg/L	CN002	1.2	mg/Kg
Dissolved Organic Carbon	DOC01	1	mg/L			
Fluoride	FL001	0.1	mg/L			
Hardness	HARD1	14	mg/L			
Hex Cr	HEXCR	10	ug/L			
Nitrate	NO301	0.04	mg/L			
Nitrite	NO201	0.01	mg/L			
Nitrite+Nitrate	NO23C	0.040	mg/L			
Oil and Grease	OG001	5	mg/L			
Ortho Phosphate	OP041	0.005	mg/L			
Phenol	PHENL	10	ug/L			
Phosphate	PO401	0.005	mg/L			
Silica	SI001	0.2	mg/L			
Sulfate	SO401	0.5	mg/L			
Sulfide	SUL01	0.2	mg/L			
Sulfite	SO201	Field Parameter				
Total Dissolved Solids	TDS01	10	mg/L			
Total Kjeldahl Nitrogen	TKN11	0.2	mg/L			
Total Organic Carbon	TOC01	1	mg/L			
Total Phosphate	TP001	0.01	mg/L			
Total Solids	TS001	10	mg/L			
Total Suspended Solids	TSS01	4	mg/L			

The "Nominal Quantitation Limit" listed for each parameter is the level of quantitation normally reported for undiluted samples. Methods used and and levels reported are as required by the analytical assignment.

October 1992

EPA Region III
Central Regional Laboratory
Metals
Nominal Quantitation Limits and Test Names

METALS

	Aqueous			Solids		
Name	Test Name	NQL	Unit	Test Name	NQL	Unit
Aluminum	AL011	200	ug/L	AL012	20	ug/g
Antimony	SB011	10	ug/L	SB012	1.0	ug/g
Arsenic	AS011	5	ug/L	AS012	0.5	ug/g
Barium	BA011	200	ug/L	BA012	20	ug/g
Beryllium	BE011	5	ug/L	BE012	0.5	ug/g
Cadmium	CD011	5	ug/L	CD012	0.5	ug/g
Calcium	CA011	1.0	mg/L	CA012	100	mg/Kg
Chromium	CR011	10	ug/L	CR012	1	ug/g
Cobalt	CO011	50	ug/L	CO012	5	ug/g
Copper	CU011	25	ug/L	CU012	2.5	ug/g
EP Tox Arsenic	EAS11	5	mg/L			
EP Tox Barium	EBA11	100	mg/L			
EP Tox Cadmium	ECD11	1	mg/L			
EP Tox Chromium	ECR11	5	mg/L			
EP Tox Lead	EPB11	5	mg/L			
EP Tox Mercury	EHG01	0.2	mg/L			
EP Tox Selenium	ESE11	1	mg/L			
EP Tox Silver	EAG11	5	mg/L			
Iron	FE011	100	ug/L	FE012	10	ug/g
Lead	PB011	3	ug/L	PB012	0.3	ug/g
Magnesium	MG011	0.5	mg/L	MG012	50	mg/Kg
Manganese	MN011	15	ug/L	MN012	1.5	ug/g
Mercury	HG001	0.2	ug/L	HG002	0.1	ug/g
Nickel	NI011	40	ug/L	NI012	4.0	ug/g
Potassium	K0011	1.0	mg/L	K0012	100	mg/Kg
Selenium	SE011	5	ug/L	SE012	0.5	ug/g
Silver	AG011	10	ug/L	AG012	1	ug/g
Sodium	NA011	1.0	mg/L	NA012	100	mg/Kg
TCLP Arsenic		5	mg/L			
TCLP Barium		100	mg/L			
TCLP Cadmium		1	mg/L			
TCLP Chromium		5	mg/L			
TCLP Lead		5	mg/L			
TCLP Mercury		0.2	mg/L			
TCLP Selenium		1	mg/L			
TCLP Silver		5	mg/L			
Thallium	TL011	5	ug/L	TL012	0.5	ug/g
Vanadium	V0011	50	ug/L	V0012	5	ug/g
Zinc	ZN011	20	ug/L	ZN012	2	ug/g

The "Nominal Quantitation Limit" listed for each parameter is the level of quantitation normally reported for undiluted samples. These levels meet or exceed the program requirements for CERCLA and RCRA. Methods used and levels reported are as required by the analytical assignment.

Central Regional Laboratory - Region III
Volatile Organics Analysis
Nominal Quantitation Limits (NQL)

Units: Aqueous = ug/L Non-aqueous = ug/Kg (Wet) NPTC = Non-Priority Pollutant Target Compound
Test: Water = VOA45 Soil = VOA46 Actual Quantitation Limit = (Dilution Factor) x NQL

CAS Number	Analyte		NQL
75-71-8	Dichlorodifluoromethane		5
74-87-3	Chloromethane		5
75-01-4	Vinyl Chloride		5
74-83-9	Bromomethane		5
75-00-3	Chloroethane		5
75-69-4	Trichlorofluoromethane		5
75-35-4	1,1-Dichloroethylene		5
75-15-0	Carbon Disulfide	NPTC	5
67-64-1	Acetone	NPTC	5
75-09-2	Methylene Chloride		5
156-60-5	trans-1,2-Dichloroethene		5
75-34-3	1,1-Dichloroethane		5
108-05-4	Vinyl Acetate	NPTC	5
590-20-7	2,2-Dichloropropane		5
156-59-4	cis-1,2-Dichloroethene	NPTC	5
78-93-3	2-Butanone	NPTC	5
74-97-5	Bromochloromethane	NPTC	5
65-66-3	Chloroform		5
71-55-6	1,1,1-Trichloroethane		5
56-23-5	Carbon Tetrachloride		5
563-58-6	1,1-Dichloro-1-propene		5
71-43-2	Benzene		5
107-06-2	1,2-Dichloroethane		5
79-01-6	Trichloroethylene		5
78-87-5	1,2-Dichloropropane		5
74-95-3	Dibromomethane	NPTC	5
75-27-4	Bromodichloromethane		5
110-75-8	2-Chloroethylvinylether		5
10061-01-6	trans-1,3-Dichloropropene	NPTC	2
108-10-1	4-Methyl-2-pentanone	NPTC	5
108-88-3	Toluene		5
10061-01-5	cis-1,3-Dichloropropene		8
79-00-5	1,1,2-Trichloroethane		5
127-18-4	Tetrachloroethylene		5
142-28-9	1,3-Dichloropropane	NPTC	5
591-78-6	2-Hexanone	NPTC	5
124-48-1	Dibromochloromethane		5
106-93-4	1,2-Dibromoethane (EDB)	NPTC	5
108-90-7	Chlorobenzene		5
630-20-6	1,1,1,2-Tetrachloroethane	NPTC	5
100-41-4	Ethylbenzene		5
108-38-3	m-Xylene) (m & p isomers	NPTC	5
106-42-3	p-Xylene together)	NPTC	5
95-47-6	o-xylene	NPTC	5
100-42-5	Styrene	NPTC	5
75-25-2	Bromoform		5
98-82-8	Isopropylbenzene	NPTC	5
108-86-1	Bromobenzene	NPTC	5
79-34-5	1,1,2,2-Tetrachloroethane		5
96-18-4	1,2,3-Trichloropropane	NPTC	5
103-65-1	n-Propylbenzene	NPTC	5
95-49-8	2-Chlorotoluene	NPTC	5
106-43-4	4-Chlorotoluene	NPTC	5
108-67-8	1,3,5-Trimethylbenzene	NPTC	5
98-06-6	tert-Butylbenzene	NPTC	5
93-63-6	1,2,4-Trimethylbenzene	NPTC	5
135-98-8	sec-Butylbenzene	NPTC	5
541-73-1	1,3-Dichlorobenzene		5
106-46-7	1,4-Dichlorobenzene		5
99-87-6	p-Isopropyltoluene	NPTC	5
95-50-1	1,2-Dichlorobenzene		5
104-51-8	n-Butylbenzene	NPTC	5
96-12-8	1,2-Dibromo-3-chloropropane	NPTC	5
120-82-1	1,2,4-Trichlorobenzene		5
91-20-3	Naphthalene		5
87-68-3	Hexachlorobutadiene		5
87-61-6	1,2,3-Trichlorobenzene	NPTC	5

The "Nominal Quantitation Limit" listed for each target compound is based on the Superfund CLP protocol. These have been verified at the Central Regional Laboratory using the method detailed by William Budde, et al., "Trace Analyses for Wastewater" Environmental Science and Technology, Volume 15, No. 12, December 1981, p. 1426-1435. The Actual Quantitation Limits are related to the NQLs by a dilution factor. This dilution factor reflects procedural steps, e.g., sample dilution, which influence the quantitation limits. The equations used for this dilution factor are as follows:

$$\text{Dilution Factor (water)} = \frac{5\text{mL (Ideal Sample Vol.)} \times \text{(Ext D. F.)}}{\text{Actual Sample Vol. (mL)}}$$

$$\text{Dilution Factor (nonaqueous)} = \frac{1^{*}\ 5\text{gm (Ideal Sample Wt.)} \times \text{(Ext D. F.)}}{\text{Actual Sample Wt. (gm)}}$$

The "Ext. D.F." in these equations refers to the extract dilution factor in the case of soils and the sample dilution factor in the case of aqueous samples.

October 1992

Central Regional Laboratory - Region III
Pesticide and PCB Analysis
Nominal Quantitation Limits (NQL)

Units: Aqueous = ug/L Non-aqueous = mg/kg (Wet) Fish = mg/kg (Wet) NPTC = Non-Priority Pollutant Target Compound
Test : Aqueous = PES61 Non-aqueous = PES62 Fish = PES44
PCB61 PCB62 PCB44

Actual Quantitation Limit = (Dilution Factor) x NQL

CAS Number	Pesticide		NQL
319-84-6	alpha-BHC		0.05
319-85-7	beta-BHC		0.05
319-86-8	delta-BHC		0.05
58-89-9	gamma-BHC		0.05
76-44-8	Heptachlor		0.05
309-00-2	Aldrin		0.05
1024-57-3	Heptachlor epoxide		0.05
959-98-8	Endosulfan I		0.05
60-57-1	Dieldrin		0.10
72-55-9	4,4'-DDE		0.10
72-20-8	Endrin		0.10
33213-65-9	Endosulfan II		0.10
72-54-8	4,4'-DDD		0.10
1031-07-8	Endosulfan sulfate		0.10
50-29-3	4,4'-DDT		0.10
7421-93-4	Endrin aldehyde		0.10
53494-70-5	Endrin ketone	NPTC	0.10
72-43-5	Methoxychlor	NPTC	0.05
5103-71-9	alpha-Chlordane		0.05
5103-74-2	gamma-Chlordane		0.05
57-74-9	Chlordane		1.0
8001-35-2	Toxaphene		5.0

CAS Number	PCB	NQL
12674-11-2	Aroclor-1016	1.0
1104-28-2	Aroclor-1221	2.0
11141-16-5	Aroclor-1232	1.0
53469-21-9	Aroclor-1242	1.0
12672-29-6	Aroclor-1248	1.0
11097-69-1	Aroclor-1254	1.0
11096-82-5	Aroclor-1260	1.0

The "Nominal Quantitation Limit" listed for each target compound is based on the Superfund CLP protocol. The Actual Quantitation Limits are related to the NQLs by a dilution factor. This dilution factor reflects procedural steps, e.g., extract dilution, which influence the quantitation limits. The equations used for this dilution factor are as follows:

$$\text{Dilution Factor (water)} = \frac{1\text{ L (Ideal Sample Vol.)}}{\text{Actual Sample Vol. (L)}} \times \frac{\text{Ext. D.F.}}{\text{10 mL (Ideal Final Vol.)}} \times \text{Final Ext. Vol. (mL)}$$

$$\text{Dilution Factor (non-aqueous)} = \frac{1}{30} \times \frac{30\text{ gm (Ideal Sample Wt.)}}{\text{Actual Sample Wt. (gm)}} \times \frac{\text{Ext. D.F.}}{\text{10 mL (Ideal Final Vol.)}} \times \text{Final Ext. Vol. (mL)}$$

$$\text{Dilution Factor (Fish)} = \frac{1}{30} \times \frac{\text{(40g (Ideal Sample Weight))}}{\text{Actual Sample Weight (gm)}} \times \frac{\text{Ext D.F.}}{\text{10 mL (Ideal Final Vol.)}} \times \text{Final Ext. Vol. (mL)}$$

The "Ext. D.F." in these equations refers to the Extract Dilution Factor. The 1/30 value, included in the equation for the non-aqueous samples, is the conversion factor between soil and water NQLs as estimated by the EPA Superfund program (one significant figure).

Rev. 2.0 (6/17/92)

Central Regional Laboratory - Region III
Pesticide and PCB Analysis
Nominal Quantitation Limits (NQL)

Units: Oil = mg/kg Wipe = ug/wipe

Test: Oil = PCB43 Wipe = PCB45

Actual Quantitation Limit = (Dilution Factor) x NQL

CAS Number	PCB	NQL
12674-11-2	Aroclor-1016	1.0
1104-28-2	Aroclor-1221	2.0
11141-16-5	Aroclor-1232	1.0
53469-21-9	Aroclor-1242	1.0
12672-29-6	Aroclor-1248	1.0
11097-69-1	Aroclor-1254	1.0
11096-82-5	Aroclor-1260	1.0

e "Nominal Quantitation Limit" listed for each target compound is based on the Superfund CLP protocol. The tual Quantitation Limits are related to the NQLs by a dilution factor. This dilution factor reflects ocedural steps, e.g., extract dilution, which influence the quantitation limits. The equations used for s dilution factor are as follows:

$$\text{ilution actor (Oil)} = \frac{1\text{ g (Ideal Sample Weight)}}{\text{Actual Sample Weight (g)}} * \text{Ext. D.F.} * \frac{\text{Final Ext. Vol. (mL)}}{\text{10 mL (Ideal Final Vol.)}}$$

$$\text{ution actor (Wipe)} = \frac{\text{1 wipe (Ideal Sample Number)}}{\text{Actual Number of Wipes}} * \text{Ext. D.F.} * \frac{\text{Final Extract Vol. (mL)}}{\text{10 mL (Ideal Final Vol.)}}$$

OTE: All wipes received in one container will be extracted together.

e "Ext. D.F." in these equations refers to the Extract Dilution Factor.

Units: Aqueous = ug/L Non-aqueous = mg/Kg (Wet) NPTC = Non-Priority Pollutant Target Compound
Test : Aqueous = EXT31 Non-aqueous = EXT32 (1) = Cannot be separated from diphenylamine
Actual Quantitation Limit = (Dilution Factor) x NQL

CAS Number	Analyte		NQL
62-75-9	N-Nitrosodimethylamine		10
108-95-2	Phenol		10
62-53-34	Aniline	NPTC	10
111-44-4	bis(2-Chloroethyl)Ether		10
95-57-8	2-Chlorophenol		10
541-73-1	1,3-Dichlorobenzene		10
106-46-7	1,4-Dichlorobenzene		10
100-51-6	Benzyl Alcohol	NPTC	10
95-50-1	1,2-Dichlorobenzene		10
95-48-7	2-Methylphenol	NPTC	10
108-60-1	bis(2-chloroisopropyl)Ether		10
106-44-5	4-Methylphenol	NPTC	10
621-64-7	N-Nitroso-di-n-Propylamine		10
67-72-1	Hexachloroethane		10
98-95-3	Nitrobenzene		10
78-59-1	Isophorone		10
88-75-5	2-Nitrophenol		10
105-67-9	2,4-Dimethylphenol		10
65-85-0	Benzoic Acid	NPTC	50
111-91-1	bis(2-Chloroethoxy)Methane		10
120-83-2	2,4-Dichlorophenol		10
120-82-1	1,2,4-Trichlorobenzene		10
91-20-3	Naphthalene		10
106-47-8	4-Chloroaniline	NPTC	10
87-68-3	Hexachlorobutadiene		10
59-50-7	4-Chloro-3-Methylphenol		10
91-57-6	2-Methylnaphthalene	NPTC	10
77-47-4	Hexachlorocyclopentadiene		10
88-06-2	2,4,6-Trichlorophenol		10
95-95-4	2,4,5-Trichlorophenol	NPTC	50
91-58-7	2-Chloronaphthalene		10
88-74-4	2-Nitroaniline	NPTC	50
131-11-3	Dimethylphthalate		10
208-96-8	Acenaphthylene		10
99-09-2	3-Nitroaniline	NPTC	50
83-32-9	Acenaphthene		10
51-28-5	2,4-Dinitrophenol		50
100-02-7	4-Nitrophenol		50
132-64-9	Dibenzofuran	NPTC	10
606-20-2	2,6-Dinitrotoluene		10
121-14-2	2,4-Dinitrotoluene		10
84-66-2	Diethylphthalate		10
7005-72-3	4-Chlorophenylphenylether		10
86-73-7	Fluorene		10
100-01-6	4-Nitroaniline	NPTC	50
86-30-6	N-Nitrosodiphenylamine(1)		10
534-52-1	4,6-Dinitro-2-Methylphenol		50
101-55-3	4-Bromophenylphenylether		10
118-74-1	Hexachlorobenzene		10
87-86-5	Pentachlorophenol		50
85-01-8	Phenanthrene		10
120-12-7	Anthracene		10
84-74-2	Di-n-Butylphthalate		10
206-44-0	Fluoranthene		10
92-87-5	Benzidine		50
129-00-0	Pyrene		10
85-68-7	Butylbenzylphthalate		10
91-94-1	3,3'-Dichlorobenzidine		20
56-55-3	Benzo(a)Anthracene		10
117-81-7	bis(2-Ethylhexyl)Phthalate		10
218-01-9	Chrysene		10
117-84-0	Di-n-Octylphthalate		10
205-99-2	Benzo(b)Fluoranthene		10
207-08-9	Benzo(k)Fluoranthene		10
50-32-8	Benzo(a)Pyrene		10
193-39-5	Indeno(1,2,3-cd)Pyrene		10
53-70-3	Dibenzo(a,h)Anthracene		10
191-24-2	Benzo(g,h,i)Perylene		10

The "Nominal Quantitation Limit" listed for each target compound is based on the Superfund CLP protocol. These have been verified at the Central Regional Laboratory using the method detailed by William Budde, et al., "Trace Analyses for Wastewater" Environmental Science and Technology, Volume 15, No. 12, December 1981, p. 1426-1435. The Actual Quantitation Limits are related to the NQLs by a dilution factor. This dilution factor reflects procedural steps, e.g., extract dilution, which influence the quantitation limits. The equations used for this dilution factor are as follows:

$$\text{Dilution Factor (water)} = \frac{1\ \text{L (Ideal Sample Vol.)} * \text{Ext.} * \text{Final Ext. Vol. (mL)}}{\text{Actual Sample Vol. (L)} \quad \text{D.F.} \quad 1\ \text{mL (Ideal Final Vol.)}}$$

$$\text{D. F. (non-aqueous)} = \frac{1 * (30\ \text{gm (Ideal Sample Wt.)}) * \text{Ext.} * \text{Final Ext. Vol. (mL)}}{30 * \text{Actual Sample Wt. (gm)} \quad \text{D.F.} \quad 1\ \text{mL (Ideal Final Vol)}}$$

The "Ext. D.F." in these equations refer to the Extract Dilution Factor. The 1/30 value, included in the equation for the non-aqueous samples, is the conversion factor between soil and water NQLs as estimated by the EPA Superfund program (one significant figure).

REGION III
CENTRAL REGIONAL LABORATORY
QUALIFIER CODES

A = Quality Control value is outside acceptance limits.

B = Not detected substantially above (10 times) the level reported in the laboratory or field blanks (includes field, trip, rinsate, and equipment blanks).

C = See report narrative for analyst's observations concerning this result.

D = Sample and duplicate value below quantitation limit. Quantitation limit reported.

E = Value exceeds a theoretically equivalent or greater value (e.g. dissolved > total, orthophosphate > total phosphorus). However, the difference is within the expected precision of the analytical techniques and is not statistically significant.

I = An interference exists which masks true response. See report narrative for explanation.

J = Analyte present. Reported value is estimated; concentration is below the level for accurate quantitation.

K = Analyte present. Reported value may be biased high. Actual value is expected to be lower.

L = Analyte present. Reported value may be biased low. Actual value is expected to be higher.

MSA= Method of Standard Additions

N = Presumptive evidence indicates the presence of compound. Special methods and/or method modifications may be needed to confirm its presence or absence in future sampling efforts.

NA = Analysis was not requested.

Q = No analytical results. See report narrative for explanation.

R = Unreliable results, Analyte may or may not be present in the sample. Supporting data is necessary to confirm results.

RPD= Results for method duplicates are expressed as the mean and the relative percent difference.

T = Tentatively identified compound. Identified as a result of a library search using the EPA/NIH Mass Spectral Library. Authentic standards were not available to properly identify and quantitate the compound. The reported concentration is an estimate.

TD = Spike recovery too dilute for accurate quantitation.

UJ = Not detected. Quantitation limit is estimated.

UL = Not detected. Quantitation limit is probably higher.

< = Sample value below quantitation limit. Quantitation limit reported.
≤ = Reported value is estimated. Sample analyzed in duplicate, one value is equal to or above the quantitation limit and one below. Average of quantitation limit and detected value reported.

Numbers in parentheses are analytical (post-digestion) spike recoveries.
Numbers in brackets are matrix [pre-digestion] spike recoveries.

PCB/PESTICIDE ANALYSIS BY GC

Analyst:

Timothy M. Casey
Chemist/Lockheed

Method:

The samples from Yorktown Naval Weapons were analyzed by capillary column gas chromatography for polychlorinated biphenyls and organochlorine pesticides listed on the priority pollutants compound list. The samples were collected on May 31, 1994. The extractions of the samples were performed on June 8, 1994. Approximately 30 gram portions of each soil sample were weighed, and the soil extracted by sonication in a 1:1 mixture of methylene chloride and acetone. Each extract was subsequently reduced to 10 mL in hexane using Kuderna-Danish flasks. All extractions and analyses were performed according to SOP R3-QA207.0. This SOP is a consolidated method derived from the Superfund CLP Statement of Work.

Analysis of all sample extracts began on June 27, 1994 and continued until June 30, 1994. All sample extracts were analyzed on a Hewlett-Packard 5890 gas chromatograph (GC) equipped with an automatic injector and dual electron capture detectors (ECDs). All samples, standards, and laboratory control solutions were run on dual columns connected by an injector port tee. The fused silica capillary column connected to the front ECD was a J&W Scientific DB-608 (30 m., 0.53 mm ID). The fused silica capillary column connected to the rear ECD was a J&W Scientific DB-1701 (30 m., 0.53 mm ID). Data were obtained from these analyses using the Millennium data acquisition and processing software. Since both the front and rear columns were fully calibrated during analyses, the lower of the results from the two columns was used for reporting.

Identification of organochlorine pesticides was accomplished by comparing retention times of known pesticides with the peaks observed in the sample extract chromatograms. A retention time window of 1% of the retention time of the standard chromatogram was used for identification of target compounds. Identification of PCBs was accomplished by matching the profile of known PCBs with patterns exhibited in the target sample chromatograms. Quantitation of multi-responding compounds was based on the average of several calibrated peaks. The quantitation of all surrogate compounds and target analytes was based on a five-point linear regression where the correlation coefficient is greater than 0.995 for pesticides, and on a three-point linear regression where the correlation coefficient is greater than 0.995 for PCBs.

The NQLs (nominal quantitation limits) are the quantitation limits that have been determined for each compound analyzed by this method. The actual quantitation limit is the NQL multiplied by an NQL factor specific for each sample. The NQL factors for each sample are listed later in the report.

All soil results are reported on a WET WEIGHT basis.

Quality Control:

The two fused silica capillary columns of the HP5890 Gas Chromatograph were calibrated with five levels of the certified pesticide standards. A breakdown check standard and a mid-level check standard were analyzed concurrent with sample analyses. To monitor instrument stability, each sample sequence was interspersed with mid-level check standards and ended with a mid-level check standard. If initial and/or continuing calibration check criteria are not satisfied for a particular analyte on one column, quantitation of that analyte will be performed using the other column (assuming valid linearity). If linearity cannot be achieved on either column, the problem will be addressed, and a new curve will be generated.

A representative standard or a three-point calibration for each Toxaphene and each PCB was analyzed at the beginning of the analytical sequence for pattern recognition or quantitation. The injection volume was 3 uL for the standards, samples, and quality control solutions. An automatic sampler (HP 7673A) was used for injection.

Continuing calibration criteria were monitored for target pesticides. The check standards analyzed at 10:37 on June 30, 1994, did not meet acceptance criteria for 4,4'-DDT and methoxychlor. The samples were initially analyzed at a dilution following florisil cleanup. The standard subsequent to the target samples indicated that column contamination had occurred which lowered the response of 4,4'-DDT and methoxychlor. The samples were reanalyzed without cleanup yielding the same response suppression effect. The compound suppression was deemed to be a matrix related effect. Additional cleanup or dilutions would not contribute to the results obtained and it was deemed appropriate to report 4,4'-DDT and methoxychlor results as estimated only. All results for these compounds have been flagged "J".

Surrogates tetrachloro-meta-xylene (TMX) and decachlorobiphenyl (DCBP) were added to all target samples and quality control samples. With each sample set, a laboratory blank and matrix spikes (in duplicate) are analyzed. An in-house performance audit is analyzed at least quarterly to assure satisfactory method performance. Recoveries and duplicate results are monitored to demonstrate acceptable system performance.

All of the ten (10) sample surrogate recoveries were within the 60% - 150% advisory windows.

All recoveries for all spiked compounds except dieldrin were within advisory limits. The sample utilized for the matrix spike and duplicate contained dieldrin at significant concentration. The variability in the dieldrin concentration has been attributed to non-homogeneity in the sample matrix. The dieldrin results should be regarded as estimated only. The sample results for dieldrin have been flagged "J". The quality control results for dieldrin have been flagged "A".

Several soil samples required sample extract dilution due to target analyte concentrations outside the calibrated range of the detector.

Several samples were observed to contain target analytes. Confirmation was performed using a column of differing selectivity.

Sample 940602-05 was observed to contain Aroclor 1254 and Aroclor 1260. The presence of these multiresponding compounds has resulted in the identification of pesticides which have been attributed to PCB peaks eluting within pesticide retention time windows. The results for these compounds have been flagged "C".

SURROGATE RECOVERY LIMITS

COMPOUND	PERCENT RECOVERY
Tetrachloro-meta-xylene	60-150
Decachlorobiphenyl	60-150

BLANK SPIKE RESULTS

SAMPLE: LFM 06/08

COMPOUND	TRUE VALUE (mg/Kg)	PERCENT RECOVERY LFM	QC LIMITS %REC
Gamma-BHC	0.0133	84	46-127
Heptachlor	0.0133	94	35-130
Aldrin	0.0133	82	34-132
Dieldrin	0.0267	86	31-134
Endrin	0.0267	93	42-139
4,4'-DDT	0.0267	94	23-134

MATRIX SPIKE RESULTS

SAMPLE: 94060202

COMPOUND	TRUE VALUE (mg/Kg)	PERCENT RECOVERY LF1	LF2	RPD	QC LIMITS %REC	RPD
Gamma-BHC	0.0133	88	84	5	46-127	50
Heptachlor	0.0133	100	98	2	35-130	31
Aldrin	0.0133	88	85	4	34-132	43
Dieldrin	0.0267	5 A	A	A	31-134	38
Endrin	0.0267	108	102	6	42-139	45
4,4'-DDT	0.0267	83 J	60 J	31	23-134	50

SAMPLE WEIGHTS AND NQL FACTORS

SAMPLE	WEIGHT	NQL FACTOR
94060201	30.0 g	1.00
94060202	30.0 g	1.00
94060203	30.0 g	10.00
94060204	30.0 g	1.00
94060205	30.0 g	10.00

$$\text{NQL FACTOR} = \frac{30\text{ g (Ideal Sample Wt.)}}{\text{Actual Sample Wt. (g)}} * \text{Ext.} * \frac{\text{Final Ext. Vol. (mL)}}{\text{D.F.}\quad 10\text{ mL (Ideal Final Vol)}} \quad \text{(Soil)}$$

Additional Quality Control Results will be provided upon request.

VOA ANALYSIS BY GC/MS

Analyst:

Sue Raupuk
Chemist/Lockheed

TID #: 03940615

Method:

One (1) aqueous sample and five (5) soil samples from Yorktown Naval Weapons were analyzed for the presence of volatile organic compounds amenable to purge and trap and identifiable by mass spectrometry. Samples were collected on May 31, 1994 and analyzed on June 6, 1994 following SOP #R3-QA210.0. This SOP is derived from the Superfund Contract Laboratory Program Statement of Work and from RCRA methodology (SW-846). Instrumentation utilized consisted of a purge and trap apparatus (Tekmar ALS 2016/LSC 2000) interfaced to a gas chromatograph/mass spectrometer (HP 5890/HP 5970) equipped with a fused silica capillary column (VOCOL 105m x 0.53mm ID x 3.0um film thickness). Concentrations of compounds were determined using the relative response of authentic standards to the closest internal standard. Only detected results are reported. Sample target compound values less than the quantitation limit were labeled with a "J". This indicates that the mass spectrum obtained for the sample met the identification criteria, yet the quantity present was below the level for which the instrument accurately quantitates. All results qualified with a "J" are estimated quantities. The NQLs (nominal quantitation limits) are the quantitation limits that have been determined for each compound analyzed by this method. The actual quantitation limit is the NQL multiplied by a NQL factor specific for each sample. The NQL factor for all samples is one (1). The NQL for all compounds was 5 ppb.

Soil sample results were uncorrected for % dry weight and reported on a WET weight basis.

The samples were also examined for the presence of compounds in addition to those on the Target Compound list. Authentic standards were not available to verify these tentatively identified compounds (TIC) results. Tentative identification of these compounds was made on the comparison of sample spectra to the EPA/NBS54K Mass Spectral Library. Concentrations for these compounds were estimated based on the response of the closest internal standard and the assumption that the instrument response for a given tentative compound was the same as the instrument response for the internal standards. These identifications have been reported as tentative identifications with the associated quantitation values reported as estimated concentrations and qualified with a "T".

Quality Control:

Before acquisition of any sample data, the mass spectrometer is calibrated using FC43. The calibration is verified by obtaining the spectrum of a known compound (BFB). All mass assignments and relative abundances are found to be in acceptable ranges or the instrument is adjusted until an acceptable

spectrum of the known is obtained. All samples and related Q.C. were analyzed within the twelve hour BFB time criteria.

Immediately before analysis, each sample is spiked with internal standards obtained from Supelco, Inc. All quantitations or estimates of concentrations are made in comparison to the internal standard nearest to the compound of interest.

The initial calibration consisted of a six-point calibration curve (5, 10, 20, 50, 100 and 200 ug/L standards). Five (5) milliliters of aqueous sample and five (5) grams of soil sample for the heated method were purged. The daily calibration check standard was analyzed at a concentration of 50.0 ppb.

For each day of sample analysis, a method blank (lab reagent blank - LRB) was prepared and examined for laboratory introduced contamination. All compounds which were found in both a LRB and/or trip blank and a sample were qualified "B" if the concentration of the compound in the sample was less than ten times (<10X) the compound's concentration in the blank.

The percent relative standard deviation (%RSD) for all compounds in the initial calibration of the instrument on June 2, 1994 for the heated method was below thirty (30) percent. The percent difference (%D) for all compounds in the continuing calibration standard on June 6, 1994 for the heated method was below twenty-five (25) percent when comparing the daily calibration standard to the initial calibration curve. These compounds are qualified "J", estimated, for the positive results and "UJ", undetected estimated, for non-detected results in the affected samples.

The samples were spiked with a mixture of surrogate compounds prior to analysis. Recovery for each was determined to check for matrix interferences. The target limits are those established by the CLP. All surrogate recoveries were within acceptable recovery limits.

Two (2) aliquots of soil sample 940602-01 were spiked with 5 ul of the matrix spike mix containing all spike compounds at a concentration of 50 ppb. The recovery for each compound was determined to check for matrix effect. Recoveries have been corrected for target compounds present in the sample. The target limits are those established by the CLP. All MS/MSD recoveries and RPDs were within CLP target limits.

An internal laboratory control sample (LCS) was analyzed with this sample set and all surrogate and compound recoveries were within the Region III CRL Q.C. Limits.

VOLATILE ORGANIC QUALITY CONTROL RESULTS

MATRIX SPIKE/MATRIX SPIKE DUPLICATE

SOIL

SAMPLE: 940602-01

PERCENT RECOVERY

COMPOUND	MS	MSD	QC LIMITS	RPD	RPD LIMITS
1,1-Dichloroethene	81	80	59-172	1	22
Trichloroethene	96	95	62-137	1	24
Benzene	109	106	66-142	3	21
Toluene	107	105	59-139	2	21
Chlorobenzene	109	102	60-133	7	21

RPD - RELATIVE PERCENT DIFFERENCE:

|REPLICATE 1-REPLICATE 2|/MEAN OF REPLICATE 1 AND 2 X 100

SURROGATE RECOVERY LIMITS

COMPOUND	WATER PERCENT RECOVERY	SOIL PERCENT RECOVERY
D4-1,2-Dichloroethane	76-114	70-121
Fluorobenzene	80-120	80-120
D8-Toluene	88-110	81-117
Bromofluorobenzene	86-115	74-121

TENTATIVELY IDENTIFIED COMPOUNDS

Site: Yorktown Naval Weapons
Program: Superfund Federal Facility

SAMPLE NO.	CAS #	TIC NAME	SCAN	CONC. (ug/Kg)
940602-01		None Detected		

SAMPLE NO.	CAS #	TIC NAME	SCAN	CONC. (ug/Kg)
940602-02		None Detected		

SAMPLE NO.	CAS #	TIC NAME	SCAN	CONC. (ug/Kg)
940602-03		None Detected		

SAMPLE NO.	CAS #	TIC NAME	SCAN	CONC. (ug/Kg)
940602-04	******	Unknown, m/z = 51	132	9 T

SAMPLE NO.	CAS #	TIC NAME	SCAN	CONC. (ug/Kg)
940602-05		None Detected		

SAMPLE NO.	CAS #	TIC NAME	SCAN	CONC. (ug/L)
940602-06		None Detected		

GC/MS EXTRACTABLE ANALYSIS

Analyst:

Hoang Nguyen
Chemist/Lockheed

TID #: 03940616

Method :

The five (5) soil samples from the Yorktown Naval Weapons site were analyzed for the presence of organic compounds listed as extractable Priority Pollutants and CLP Hazardous Substances List Compounds. The samples were collected on May 31, 1994. The soil samples were extracted by the sonication method on June 03, 1994. These samples were analyzed on June 08, 09 and 14, 1994 following SOP# R3-QA211.0. This SOP is a consolidated method derived from the Superfund Contract Laboratory Program Statement of Work and from RCRA methodology (SW-846). Instrumentation utilized consisted of a Hewlett Packard (HP) 5970 MSD coupled to a HP 5890 Series II gas chromatograph equipped with an HP-7673A auto-sampler and SPB-5 30 meter capillary column. Concentrations of compounds were determined using the relative response of authentic standards to the closest internal standard. The soil concentration results are reported on a wet weight basis. These values have been reported in the RLIMS Final Report. Only those compounds for which results are reported were detected. Sample target compound values less than the quantitation limit were labeled with a "J". This indicates that the mass spectra obtained for the sample met the identification criteria, yet the quantity present was below the level for which the instrument accurately quantitates. These results, qualified with a "J", should be considered estimated quantities. The NQL (nominal quantitation limit) listed on the Extractable Organic Analysis NQL sheet is the quantitation limit that has been determined for this method. The actual quantitation limit for a sample reflects the NQL as well as the NQL factor specific for each sample. All samples were analyzed at an NQL factor of 1.

The samples were also examined for the presence of compounds in addition to those on the Target Compound list. Authentic standards were not available to verify these tentatively identified compound (TIC) results. Tentative identification of these compounds was made by the comparison of sample spectra to the EPA/NBS54K Mass Spectral Library. Concentrations for these compounds were estimated based on the response of the closest internal standard and the assumption that the instrument response for a given tentative compound was the same as the instrument response for the internal standards. These identifications have been reported as tentative identifications with the associated quantitation values reported as estimated concentrations and qualified with a "T". The TICs in all sample extracts have been corrected for any blank contamination.

Quality Control:

Before acquisition of any sample data, the mass spectrometer is calibrated using FC43. The calibration is verified by obtaining the spectrum of a known compound (DFTPP). All mass assignments and relative abundances are found to be in acceptable ranges or the instrument is adjusted until an acceptable spectrum of the known is obtained.

Immediately before analysis, each sample is spiked with an internal standard mix from Supelco, Inc. containing D4-1,4-dichlorobenzene, D8-naphthalene, D10-acenaphthene, D10-phenanthrene, D12-chrysene and D12-perylene. All quantitations or estimates of concentration are made in comparison to the internal standard nearest to the compound of interest.

Quantitation was based on the 50 ng/ul standard, and the initial calibration consisted of a five (5) point calibration (10, 20, 50, 80 and 100 ng/ul) except for benzoic acid and 2,4-dinitrophenol analyzed on June 08, 1994 which consisted of a four point calibration (20, 50, 80 and 100 ng/ul). The percent relative standard deviation (%RSD) for all compounds except for benzoic acid and 2,4-dinitrophenol in the initial calibration of the instrument on June 08, 1994 was below thirty (30) percent. The %RSD for all compounds except for benzoic acid in the initial calibration of the instrument on June 09, 1994 was below thirty (30) percent. The %RSD for all compounds in the initial calibration of the instrument on June 10, 1994 was below thirty (30) percent. The percent difference (%D) for all compounds in the continuing calibration check standard on June 08 and 09, 1994 was below twenty-five (25) percent when comparing the daily calibration standard to the initial calibration curve. The %D for all compounds in the continuing calibration check standard on June 14, 1994 was below twenty-five (25) percent except for benzoic acid when comparing the daily calibration standard to the initial calibration curve. These compounds are qualified "J", estimated, for the positive results and "UJ", undetected estimated, for non-detected results in the affected samples.

The "Nominal Quantitation Limit" (NQL) listed for each target compound is based on the Superfund CLP protocol. These have been verified at the Central Regional Laboratory using the method detailed by William Budde, et al., "Trace Analyses for Wastewater" Environmental Science and Technology, Volume 15, No. 12, December 1981, p. 1426-1435. As indicated on the Target Compound Data Sheet, the Actual Quantitation Limits are related to the NQLs by a factor. This factor reflects procedural steps, e.g., extract dilution, which influence the quantitation limits. The equations used for this factor are as follows:

$$\text{Factor (water)} = \frac{(1\text{ L(Ideal Sample VOL.))}}{\text{Actual Sample Vol.(L)}} * \text{Ext. D.F.} * \frac{\text{Final Ext. Vol. (mL)}}{\text{1 mL (Ideal Final Vol.)}}$$

$$\text{Factor (non-aqueous)} = \frac{1}{30} * \frac{(30\text{g (Ideal sample Wt.))}}{\text{Actual Sample Wt.(gm)}} * \text{Ext.D.F.} * \frac{\text{Final Ext. Vol. (mL)}}{\text{1 mL(Ideal Final Vol.)}}$$

The "Ext.D.F." in these equations refers to the Extract Dilution Factor. The 1/30 value, included in the equation for the non-aqueous samples, is the conversion factor between soil and water NQLs as estimated by the EPA Superfund program (one significant figure).

Quality Control:(cont'd)

For each group of samples extracted, a method blank is prepared and examined for laboratory introduced contamination. Only target compounds in the samples with values less than or equal to ten times (<10) the method blank, field blank, rinsate blank and/or equipment blank are reported with a "B" qualifier.

The samples were spiked with a mixture of six surrogate compounds prior to extraction. Recovery for each was determined to check for matrix effect. All surrogate recoveries were within Q.C. limits. The target limits are those established for the CLP.

Two (2) aliquots of sample 940602-01 were spiked with a priority pollutant cocktail mix containing twelve compounds at 100 ng/uL for acid and 50 ng/uL for base/neutral (in the extract) and carried through the extraction and GC/MS. All matrix spike recoveries and all %RPDs were within acceptable limits. Recoveries have been corrected for target compounds present in the sample.

SOIL SURROGATE RECOVERY LIMITS

COMPOUND	PERCENT RECOVERY
2-FLUOROPHENOL	25-121
D5-PHENOL	24-113
D5-NITROBENZENE	23-120
2-FLUORO-1,1'-BIPHENYL	30-115
2,4,6-TRIBROMOPHENOL	19-122
D14-TERPHENYL	18-137

SOIL MATRIX SPIKE RECOVERY

SAMPLE: 940602-01

COMPOUND	% RECOVERY MS	% RECOVERY MSD	LIMIT % REC.	RPD	RPD LIMIT
PHENOL	55	52	26 - 90	5	35
2-CHLOROPHENOL	61	60	25 -102	2	50
1,4-DICHLOROBENZENE	71	69	28 -104	3	27
N-NITROSO-di-n-PROPYLAMINE	67	67	41 -126	0	38
1,2,4-TRICHLOROBENZENE	79	74	38 -107	6	23
4-CHLORO-3-METHYLPHENOL	67	63	26 -103	7	33
ACENAPHTHENE	81	75	31 -137	7	19
4-NITROPHENOL	71	61	11 -114	15	50
2,4-DINITROTOLUENE	75	71	28 - 89	6	47
PENTACHLOROPHENOL	36	40	17 -109	10	47
DIBUTYLPHTHALATE	85	80	29 -135	6	40
PYRENE	83	86	35 -142	3	36

$$RPD = \frac{|\text{Replicate 1} - \text{Replicate 2}|}{\text{Mean of Replicate 1 and 2}} \times 100$$

A = Quality control value is outside acceptance limits

TENTATIVELY IDENTIFIED COMPOUNDS

Site: Yorktown Naval Weapons
Program: Superfund-Federal Facilities

UNITS: mg/Kg

SAMPLE NO.	CAS #	TIC NAME	RT	CONC
940602-01	******	Unknown m/z = 43	9.74	0.3 T
	******	Unknown m/z = 43	25.69	0.5 T
	******	Unknown m/z = 43	26.30	2 T
	******	Unknown m/z = 193	30.86	0.3 T
	******	Unknown alkane m/z = 57	31.46	0.5 T
	******	Unknown alkane m/z = 57	33.39	0.3 T

UNITS: mg/Kg

SAMPLE NO.	CAS #	TIC NAME	RT	CONC
940602-02	******	Unknown m/z = 43	9.75	0.3 T
	******	Unknown m/z = 57	30.02	0.5 T
	******	Unknown m/z = 69	31.01	0.3 T
	******	Unknown alkane m/z = 57	31.46	1 T
	******	Unknown m/z = 43	32.80	0.3 T
	******	Unknown alkane m/z = 57	33.38	0.3 T
	******	Unknown m/z = 143	34.00	0.3 T
	******	Unknown m/z = 239	35.87	1 T
	******	Unknown m/z = 41	37.62	0.9 T

UNITS: mg/Kg

SAMPLE NO.	CAS #	TIC NAME	RT	CONC
940602-03	******	Unknown m/z = 43	9.76	0.3 T
	******	Unknown m/z = 109	29.04	0.3 T
	******	Unknown m/z = 69	31.02	0.3 T
	******	Unknown alkane m/z = 57	31.45	1 T
	******	Unknown alkane m/z = 57	33.37	1 T
	******	Unknown m/z = 83	33.49	1 T
	******	Unknown m/z = 43	35.87	0.5 T
	******	Unknown m/z = 57	36.03	0.4 T
	******	Unknown m/z = 43	37.52	0.7 T

UNITS: mg/Kg

SAMPLE NO.	CAS #	TIC NAME	RT	CONC
940602-04	******	Unknown m/z = 131	28.31	0.3 T
	******	Unknown alkane m/z = 57	30.00	0.4 T
	******	Unknown alkane m/z = 57	31.44	0.6 T
	******	Unknown m/z = 43	32.80	0.2 T
	******	Unknown alkane m/z = 57	33.36	0.2 T
	******	Unknown m/z = 43	35.26	0.2 T

UNITS: mg/Kg

SAMPLE NO.	CAS #	TIC NAME	RT	CONC
940602-05	******	Unknown m/z = 43	9.74	0.3 T
	******	Unknown alkane m/z = 57	31.44	0.3 T
	******	Unknown alkane m/z = 57	33.34	0.3 T

METALS DETERMINATIONS

Analysts:

R.T. McClain	M.T. Wilkerson	J.L. Molnar	M.J. Chang
Lockheed Chemist	Lockheed Chemist	Lockheed Chemist	Lockheed Chemist

Methods:

Samples 940602-01 through 940602-05 from Yorktown Naval Weapons were prepared for analysis by acid digestion and analyzed by furnace atomic absorption spectroscopy and inductively coupled plasma optical emission spectrometry. The results are presented in the attached table. The following are the digestion and analytical techniques and methods employed:

Digestion Methods

Method from CLP SOW 9/91 revision, p. D-5, A.1. for Furnace AAS (excluding antimony)
Method from CLP SOW 9/91 revision, p. D-5, A.2. for ICP-AES, Flame AAS, and antimony by Furnace AAS
Method 3050, excluding HCl for furnace AAS (excluding antimony) (solid samples) (1)
Method 3050, for ICP-AES, Flame AAS, and antimony by Furnace AAS (solid samples) (1)

Analytical Methods

EPA Method 204.2 and Internal SOP R3-QA132, antimony by Furnace AAS (2)
EPA Method 206.2 and Internal SOP R3-QA132, arsenic by Furnace AAS (2)
EPA Method 239.2 and Internal SOP R3-QA132, lead by Furnace AAS (2)
EPA Method 270.2 and Internal SOP R3-QA132, selenium by Furnace AAS (2)
EPA Method 279.2 and Internal SOP R3-QA132, thallium by Furnace AAS (2)
EPA Method 200.7 and Internal SOP R3-QA132, remaining elements by ICP-AES (2)

(1) SW-846, 2nd Edition, Test Methods for Evaluating Solid Waste Physical /Chemical Methods
(2) 1979/83 EPA Manual of Methods for Chemical Analysis of Water and Wastes

Results for solid samples are reported in ug/g (ppm) DRY weight at 60 degrees centigrade. This, Percent Dry Weight test, pertains only to metals results. The drying temperature of 60 degrees centigrade is selected to retain volatile elements. The Percent Dry Weight (60°C) is reported to allow for conversion to wet weight.

Quality Control:

Samples analyzed in duplicate (method duplicates) are reported as the Mean and the Relative Percent Difference (RPD) of the two analytical values. The RPD is calculated by the following formula:

$$\frac{|(\text{Duplicate 1} - \text{Duplicate 2})|}{\text{Mean}} \times 100\% = \text{RPD}$$

Routine Quality Control (QC) performed includes preparation and analysis of audit materials; check standards; interference check samples (ICS--for ICP-AES only); method blanks; method spikes; analytical spikes; method duplicates; and analytical duplicates. Calibration standards for ICP-AES are prepared from NIST stock solutions. Calibration standards for Furnace AAS are prepared from Baker stock solutions. Method blanks are prepared with each analytical set and are acceptable if they are found to be below the quantification level for the sample set. Audit materials are analyzed at the beginning of each run to document proper instrument calibration. For ICP-AES the acceptable range is 90-110% recovery; for other techniques it is the 95% confidence interval generated using the True Values and algorithms from EMSL-Cincinnati. Check standards are analyzed periodically (generally a 1/10 frequency) throughout the run to document instrumental stability, and are acceptable at 90-110%. The ICS is obtained from EMSL-Las Vegas and is analyzed at the beginning of each ICP-AES run to document proper selection of analytical lines, background correction factors, and interelement correction factors; it is acceptable at 80-120% recovery. The remaining QC items are sample specific and are performed at a frequency of 1/10 samples for sample sets $\geq$ 10 and 1 per sample set for sample sets <10, except for analytical spikes for Furnace AAS which requires a passing analytical spike or successful Method of Standard Additions for each sample. Acceptance limits for Precision (method and instrumental duplicates) are generated for each element/matrix/analytical procedure using a Shewhart Chart and the most recent 25 duplicate values. Acceptance limits for analytical spikes for Flame AAS and for ICP-AES are generated for 95% confidence intervals for each element/matrix/analytical procedure using the most recent 25 spike recoveries. Acceptance limits for analytical spikes for Furnace AAS are set at 85-115%. Acceptance limits for matrix spikes is 80-120% recovery; when matrix spikes fail an acceptable analytical spike must be prepared and analyzed.

NOTE: The detection limit of silver for sample 940602-03 has been raised due to matrix interferences.

ICP-AES Metals Quality Control Results

Project Name: YORKTOWN NAVAL WEAPONS - SUPERFUND F/F

Sample Number:	940602-01	940602-02
METALS	SOIL	SOIL
Aluminum	RPD=9	(103%)
Barium	RPD=4	[103%]
Beryllium		[105%]
Cadmium		[104%]
Calcium	RPD=0	(105%)
Chromium	RPD=2	[97%]
Cobalt		[96%]
Copper	RPD=5	[95%]
Iron	RPD=2	(109%)
Lead	RPD=12	[108%]
Magnesium	RPD=4	[94%]
Manganese	RPD=4	[107%]
Nickel		[92%]
Potassium	RPD=8	[102%]
Silver		[95%]
Sodium		(103%)
Vanadium	RPD=6	[90%]
Zinc	RPD=3	(110%)

Numbers in brackets are pre-digestion [matrix] spike recoveries.
Numbers in parentheses are post-digestion (analytical) spike recoveries.
RPD = Results for method duplicates are expressed as the mean and the relative percent difference.

Additional quality control data are available upon request.

Furnace AAS Metals Quality Control Results

Project Name: YORKTOWN NAVAL WEAPONS - SUPERFUND F/F

Sample Number:	940602-01		940602-02	940602-03
METALS	SOIL		SOIL	SOIL
Antimony	(107%)		(109%)	(94%)
Arsenic	(98%)	RPD=5	(89%)	(88%)
Selenium	(85%)	RPD=0	(105%)	(98%)
Thallium	(96%)		(105%)	(108%)
Percent Dry Weight	RPD=1			

Sample Number:	940603-04	940603-05
METALS	SOIL	SOIL
Antimony	(112%)	(95%)
Arsenic	(97%)	(102%)
Selenium	(93%)	(103%)
Thallium	(87%)	(105%)

Numbers in parentheses are post-digestion (analytical) spike recoveries.
RPD = Results for method duplicates are expressed as the mean and the relative percent difference.

Additional quality control data are available upon request.

MERCURY DETERMINATIONS

Analyst:

Melanie T. Wilkerson
Chemist/Lockheed

TID #: 03940612

Method:

Samples 940602-01 through 940602-05 from Yorktown Naval Weapons were analyzed for total mercury using EPA Method 245.5[1].

[1]Methods for Chemical Analysis of Water and Wastes, EPA 600/4-79-020.

Results for solid samples are reported in ug/g (ppm) DRY weight at 60° degrees centigrade. This, Percent Dry Weight test, pertains only to metals results. The drying temperature of 60° degrees centigrade is selected to retain volatile elements. The Percent Dry Weight (60°) is reported to allow for conversion to wet weight.

Quality Control:

Numbers in brackets are method spike recoveries.

Lab No.	Result
940602-02	[97%]

Additional quality control data are available upon request.

PERCENT DRY WEIGHT DETERMINATIONS

Analyst:

William Pabst, III
Chemist/Lockheed

TID: 03940613

Method:

The soil samples from Yorktown Naval Weapons (Batch ID # 94088) were analyzed for Percent Dry Weight as required by EPA analytical methods. The samples were dried at 105°C following the procedure outlined in EPA Region III Central Regional Laboratory's SOP #R3QA056.0.

These results are to be used to convert analyte concentrations to a dry weight basis for organic and non-metal analyses. Normally, analytical values are reported on a wet weight basis for organics and non-metals. All metals reported use a 60°C drying temperature for the percent dry weight determinations, as required by the methodology. The 60°C percent dry weight values are reported with the metals results, if applicable.

Sample quality control results for this test are presented below.

Weighing dishes used for these samples were sequentially numbered, oven-dried overnight at 105°C, and then cooled in a desiccator before the empty dish weight was recorded. Five to ten grams of each sample was then placed on an empty dish and the total weight recorded. The samples were then placed in an oven and oven-dried overnight at 105°C. When the samples were removed from the oven they were cooled in a desiccator before their weight was recorded for the determination of percent dry weight. All weights were recorded after all appropriate calibration checks were completed on the balance using Class S weights.

Quality Control:

Percent Dry Weight Quality Control Results

Lab. No.	Percent Dry Wt	Reported Result	Relative Percent Difference
940602-05	92.7	93.8	2
940602-05 DUP	94.9	93.8	

The calculations that were used to determine Relative Percent Difference (RPD) are as follows:

$$\frac{(\text{Result \#1} - \text{Result \#2})}{(\text{Result \#1} + \text{Result \#2})/2} \times 100 = \text{RPD}$$

ENVIRONMENTAL PROTECTION AGENCY
Office of Enforcement

CHAIN OF CUSTODY RECORD

REGION 3
841 Chestnut St.
Philadelphia, Pennsylvania 19107

PROJ. NO.	PROJECT NAME
21610	Naval Weapons Station, Yorktown

SAMPLERS: (Signature) Liz K. Rowles

STA. NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	VOA	Pest/PCB	BNA	Metals		REMARKS
												Tag # / Pres. / Other
16-02	5/31/94	1445		X	EPA-SS-16-01	8	-	3	3	94[illegible]201	3-1189122-3-1189129	/ — / DO QC
16-03	5/31/94	1533		X	EPA-SS-16-02	3	-	1	1	94[illegible]202	3-1189130-3-1189132	/ — / —
16-04	5/31/94	1600		X	EPA-SS-16-03	3	-	1	1	94[illegible]203	3-1189133-3-1189135	/ — / —
16-05	5/31/94	1615		X	EPA-SS-16-04	3	-	1	1	94[illegible]204	3-1189136-3-1189138	/ — / —
16-06	5/31/94	1645		X	EPA-SS-16-05	3	-	1	1	94[illegible]205	3-1189139-3-1189141	/ — / —

Liz K. Rowles

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Liz K. Rowles	5/31/94 2200				
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature) Alice Jay Hall	Date / Time 6/2/94 1010	Remarks Fed Ex # 1661656216	

Distribution: Original Accompanies Shipment; Copy to Coordinator Field Files

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From (Your Name) Please Print — Your Phone Number (Very Important)
Company — Department/Floor No.
Street Address
City — State — ZIP Required

2 To (Recipient's Name) Please Print — Recipient's Phone Number (Very Important)
Company — Department/Floor No.
Exact Street Address (We Cannot Deliver to P.O. Boxes or P.O. Zip Codes.)
City — State — ZIP Required

YOUR INTERNAL BILLING REFERENCE INFORMATION (optional) (First 24 characters will appear on invoice.)

H IF HOLD AT FEDEX LOCATION, Print FEDEX Address Here
Street Address
City — State — ZIP Required

3 PAYMENT 1 ☐ Bill Sender 2 ☐ Bill Recipient's FedEx Acct. No. 3 ☐ Bill 3rd Party FedEx Acct. No. 4 ☐ Bill Credit Card 5 ☐ Cash/Check

4 SERVICES (Check only one box)

Priority Overnight	Standard Overnight
11 ☐ OTHER PACKAGING	51 ☐ OTHER PACKAGING
16 ☐ FEDEX LETTER*	56 ☐ FEDEX LETTER*
12 ☐ FEDEX PAK*	52 ☐ FEDEX PAK*
13 ☐ FEDEX BOX	53 ☐ FEDEX BOX
14 ☐ FEDEX TUBE	54 ☐ FEDEX TUBE
Economy Two-Day	**Government Overnight** (Restricted for authorized users only)
30 ☐ ECONOMY*	46 ☐ GOV'T LETTER
* Economy Letter Rate not available. Minimum charge One pound Economy rate	41 ☐ GOV'T PACKAGE

Freight Service (for packages over 150 lbs.)
70 ☐ OVERNIGHT FREIGHT** 80 ☐ TWO-DAY FREIGHT**
(Confirmed reservation required)
† Delivery commitment may be later in some areas. *Declared Value Limit $500 **Call for delivery schedule

5 DELIVERY AND SPECIAL HANDLING (Check services required)

Weekday Service
1 ☐ HOLD AT FEDEX LOCATION WEEKDAY (Fill in Section H)
2 ☑ DELIVER WEEKDAY

Saturday Service
31 ☐ HOLD AT FEDEX LOCATION SATURDAY (Fill in Section H)
3 ☐ DELIVER SATURDAY (Extra charge) (Not available to all locations)
9 ☐ SATURDAY PICK-UP (Extra charge)

Special Handling
4 ☐ DANGEROUS GOODS (Extra charge)
6 ☐ DRY ICE Dangerous Goods Shipper's Declaration not required
Dry Ice, 9, UN 1845, ______ x ______ kg. 904 III
12 ☐ HOLIDAY DELIVERY (If offered) (Extra charge)

6 PACKAGES — WEIGHT In Pounds Only — YOUR DECLARED VALUE (See right)
Total — Total — Total

DIM SHIPMENT (Chargeable Weight) ☐ lbs.
L x W x H

Received At
1 ☐ Regular Stop 3 ☐ Drop Box 4 ☐ B.S.C. 2 ☐ On-Call Stop 5 ☐ Station

Emp. No. — Date
☐ Cash Received
☐ Return Shipment
☐ Third Party ☐ Chg. To Del. ☐ Chg. To Hold
Street Address
City — State — Zip
Received By:
Date/Time Received — FedEx Employee Number

7 Release Signature:

1994 JUN

Federal Express Use
Base Charges
Declared Value Charge
Other 1
Other 2
Total Charges

REVISION DATE 12/92
PART #137205 GBFE
FORMAT #158

158

Annapolis, Maryland

HAZARD AND RISK EXPOSURE DATA SHEET

LEVELS OF PERSONAL PROTECTION DURING SAMPLING

BACKGROUND

Under the authority of Section 104 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund) of 1980, Section 311 of the Clean Water Act, and Subtitle I of the Resource Conservation and Recovery Act (RCRA), EPA has been delegated the responsibility to undertake response actions with respect to the release or potential release of oil, petroleum, or hazardous substances that pose a substantial threat to human health or welfare, or the environment.

GENERAL

This form is to be used when collecting Environmental Samples (i.e. streams, farm ponds, wells, soils etc.) and for Hazardous Samples (i.e. drums, storage tanks, lagoons, leachates, hazardous waste sites). This information is intended for use as a guide for the safe handling of these laboratory samples in accordance with EPA and OSHA regulations. The sample classification(s) and levels of personal protection used by the sampler in all situations will enable the analyst to be better aware of potential exposure to substances in air, splashes of liquids, or other direct contact with material due to work being done.

DEGREE OF PROTECTION

_____ Level A: Highest level of respiratory, skin, and eye protection needed.
Fully encapsulated suit, respirator self-contained (Tank type)

_____ Level B: Highest level of respiratory protection but lesser level of skin protection needed.
Chemical suit, respirator self-contained (Tank type)

_____ Level C: Lesser level of respiratory protection than Level B. Skin protection criteria are similar to Level B.
Chemical suit, cannister respirator/cartridge

X Level D: Work uniform without any respirator or skin hazards.
Lab coat, gloves etc.

CLASSIFIED FIELD SAMPLES

X Environmental ____ Hazardous ____ Comb. (Env. & Haz.) ____ Radioactive

Site Name: Naval Weapons Station Yorktown Sampling Date: 5/31/94

Sta No. ALL Soil Samples, _____, _____, _____, _____, _____, _____

Field pH: _____, _____, _____, _____, _____, _____, _____, _____, _____, _____

(must be taken prior to submission of aqueous samples)

Sampler: Leif Rowles Work Phone Number: 215-928-2212

Personal observations at time of sampling (surroundings): Excavation areas near former landfills. No unusual odors. Debris and scrap metal present

Sample collection observations (physical sample, odors etc.) No unusual odors.

ENVIRONMENTAL PROTECTION AGENCY
Office of Enforcement

REGION 3
841 Chestnut St.
Philadelphia, Pennsylvania 19107

CHAIN OF CUSTODY RECORD

PROJ. NO.: 1610
PROJECT NAME: Naval Weapons Station, Yorktown
SAMPLERS: (Signature) Leif K. Bowles

STA. NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	VOA	Pest/PCB	BNA	Metals	Tag #'s	Preservative	REMARKS
16-01	5/31/94	1107		X	TB-16-01	3	3	–		94060206	3-1189100 – 3-1189103	HCL Pres, pH<2	
16-02	5/31/94	1445		X	EPA-SS-16-01	6	6	–		94060201	3-1189104 – 3-1189109	–	(NO QC)
16-03	5/31/94	1533		X	EPA-SS-16-02	3	3	–		94060202	3-1189110 – 3-1189112	–	
16-04	5/31/94	1600		X	EPA-SS-16-03	3	3	–		94060203	3-1189113 – 3-1189115	–	
16-05	5/31/94	1615		X	EPA-SS-16-04	3	3	–		94060204	3-1189116 – 3-1189118	–	
16-06	5/31/94	1645		X	EPA-SS-16-05	3	3	–		94060205	3-1189119 – 3-1189121	–	

Leif K. Bowles

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Leif K. Bowles	5/31/94 2200				
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature) Linda Vaughan	Date / Time	Remarks	
			6/2/94 10:31	Fed Ex # 3821122675	

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RECIPIENT'S COPY

Date 6/1/94

From (Your Name) Please Print

Your Phone Number (Very Important)

Company

Department/Floor No.

Street Address

City State ZIP Required

2 To (Recipient's Name) Please Print

Recipient's Phone Number (Very Important)

Company

Department/Floor No

Exact Street Address (We Cannot Deliver to P.O. Boxes or P.O. Zip Codes.)

City State ZIP Required

YOUR INTERNAL BILLING REFERENCE INFORMATION (First 24 characters will appear on invoice.)

3 PAYMENT 1 [X] Bill Sender 2 [ ] Bill Recipient's FedEx Acct No 3 [ ] Bill 3rd Party FedEx Acct No 4 [ ] Bill Credit Card 5 [ ] Cash/Check

H IF HOLD FOR PICK-UP, Print FEDEX Address Here (Not available at all locations)

Street Address

City State ZIP Required

4 SERVICES (Check only one box)

Priority Overnight (Delivery by next business morning†) 11 [X]	Standard Overnight (Delivery by next business afternoon†) 51 [ ]
Economy Two-Day (Delivery by second business day†) 30 [ ]	Government Overnight (Restricted to authorized users only) 41 [ ]

Freight Service (for Extra Large or any package over 150 lbs.)

70 [ ] OVERNIGHT FREIGHT ** (Confirmed reservation required) † Delivery commitment may be later in some areas

80 [ ] TWO-DAY FREIGHT ** ** Declared Value Limit $100. ** Call for delivery schedule

INSTRUCTIONS (Mark appropriate boxes)

- Dangerous Goods as per attached Shipper's Declaration [X]
- Dangerous Goods Shipper's Declaration not required [ ]
- Cargo Aircraft only [ ]

DELIVERY AND SPECIAL HANDLING (Check services required)

1 [ ] HOLD FOR PICK-UP (Fill in Box H)

2 [X] DELIVER WEEKDAY

3 DELIVER SATURDAY (Extra charge) [ ] (Not available to all locations)

4 [X] DANGEROUS GOODS (Extra charge)

6 [ ] DRY ICE Lbs

- Dangerous Goods Shipper's Declaration not required
- Dry Ice, 9, UN 1845, x kg.

7 [ ] OTHER SPECIAL SERVICE

11 [ ]

12 [ ] HOLIDAY DELIVERY (If offered) (Extra charge)

PACKAGES | WEIGHT in Pounds Only

Total Total

DIM SHIPMENT (Chargeable Weight) [ ] lbs.

Received At

1 ☐ Regular Stop 3 ☐ Drop Box 4 ☐ BSC 2 ☐ On-Call Stop 5 ☐ Station

FedEx Emp. No. Date/Time

Emp. No. Date

☐ Cash Rec'd ☐ Bill Third Party ☐ Chg. To Hold

Street Address

City State Zip

Received By X

Date/Time Received FedEx Employee Number

SIGNATURE RELEASE UNAVAILABLE

Federal Express Use

Base Charges

Declared Value Charge

Other 1

Other 2

Total Charges

REVISION DATE 2/91
PART # 137 11 MBFAN
FORMAT #069 10/91

069

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Region III, Central Regional Laboratory

Annapolis, Maryland

HAZARD AND RISK EXPOSURE DATA SHEET

LEVELS OF PERSONAL PROTECTION DURING SAMPLING

BACKGROUND

Under the authority of Section 104 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund) of 1980, Section 311 of the Clean Water Act, and Subtitle I of the Resource Conservation and Recovery Act (RCRA), EPA has been delegated the responsibility to undertake response actions with respect to the release or potential release of oil, petroleum, or hazardous substances that pose a substantial threat to human health or welfare, or the environment.

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_____ Level A: Highest level of respiratory, skin, and eye protection needed.
Fully encapsulated suit, respirator self-contained (Tank type)

_____ Level B: Highest level of respiratory protection but lesser level of skin protection needed.
Chemical suit, respirator self-contained (Tank type)

_____ Level C: Lesser level of respiratory protection than Level B. Skin protection criteria are similar to Level B.
Chemical suit, cannister respirator/cartridge

X Level D: Work uniform without any respirator or skin hazards.
Lab coat, gloves etc.

CLASSIFIED FIELD SAMPLES

X Environmental ____ Hazardous ____ Comb. (Env. & Haz.) ____ Radioactive

Site Name: Naval Weapons Station, Yorktown Sampling Date: 5/31/94

Sta No. ~~[illegible]~~, 16-01 (LKR), ____, ____, ____, ____, ____, ____, ____, ____

Field pH: ____, <2, ____, ____, ____, ____, ____, ____, ____, ____

(must be taken prior to submission of aqueous samples)

Sampler: Leif Rowles Work Phone Number: 215 928 2212

Personal observations at time of sampling (surroundings):

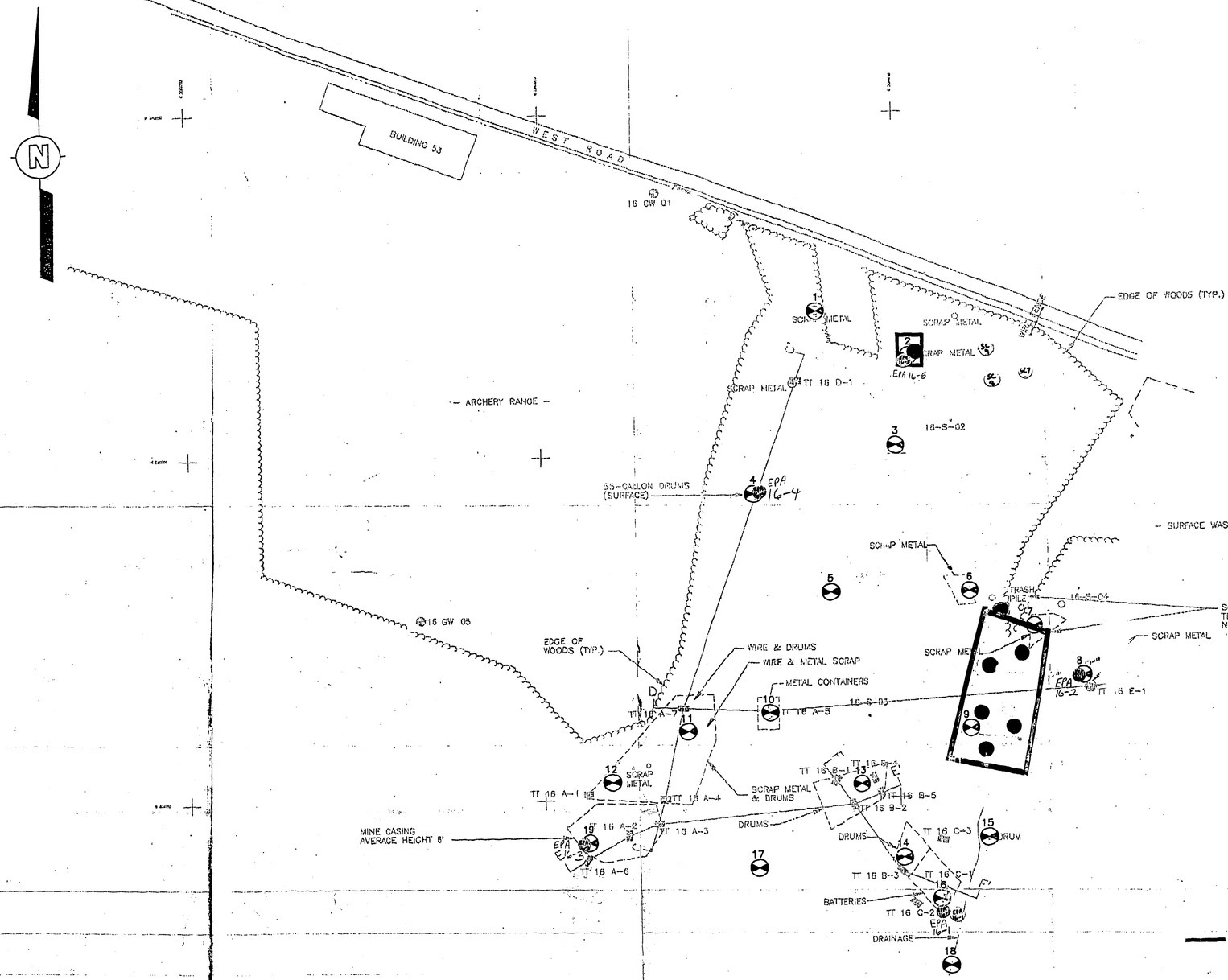
Excavation areas near former landfills. No unusual odors. Debris and scrap metal present.

Sample collection observations (physical sample, odors etc.)

No unusual odors.

Note: Station 16-01 was a field trip blank w/HCL preservative

DRAWING NUMBER 3045C2



NOTES:

1. SITE FEATURES SHOWN ARE BASED ON TOPOGRAPHICAL SURVEY AND VISUAL INSPECTIONS AND ARE APPROXIMATE.
2. SURFACE SAMPLE GRID IS SPACED AT 100' INTERVALS. ADDITIONAL SURFACE SAMPLES MAY BE REQUIRED BY THE CONTRACTING OFFICER. THE LOCATIONS OF THE SURFACE SAMPLES ARE SUBJECT TO CHANGE BASED UPON EXISTING FIELD CONDITIONS.
3. EXISTING WOODS CONSIST OF SMALL PINES AND OAKS UP TO 18 INCHES IN DIAMETER WITH SPARSE TO MODERATE UNDERGROWTH, WITH A FEW LARGER TREES UP TO 36 INCHES IN DIAMETER.
4. REFER TO SHEET 4 FOR SAMPLE LOCATIONS.

LEGEND:

- 20 CONTOUR
- EXISTING FENCE
- EDGE OF WOODS
- EXISTING ROAD, GRAVEL OR BITUMINOUS
- EXISTING DIRT ROAD
- TEMPORARY ACCESS ROAD
- 21 GW 03 GROUNDWATER MONITORING WELL
- TT 16A-2 TEST TRENCH
- 21GW04 HYDROPUNCH WELL
- LIMITS OF SURFACE AND SUBSURFACE REMOVAL
- SEDIMENT FENCE
- LIMITS OF SURFACE WASTE REMOVAL
- DISPOSAL AREA 1 WASTE REMOVAL AND REGRADING LIMITS
- 43 PROPOSED SURFACE SAMPLING LOCATION

0 40 80
SCALE (Feet)

Areas where soil screening samples contained levels of PCB's in the 10 to 50 ppm range.

EPA Soil samples sent to laboratory

EPA PCB screening samples

SURFACE SAMPLE LOCATIONS

Ref: Topographical survey performed by:
Baldwin and Gregg, 221 West Bute Street, Norfolk, Virginia

FIGURE 3

NAVAL CONSTRUCTION BATTALION CENTER
NAVAL FACILITIES ENGINEERING COMMAND
PORT HUENEME, CALIFORNIA
CONTRACT NO. 408-92-D-3045
DELIVERY ORDER 0002

TITLE
SITE 16
PROPOSED SURFACE SAMPLE LOCATIONS

INTERNATIONAL TECHNOLOGY CORPORATION
... Creating a Safer Tomorrow

REVISION	DATE	BY	CHK'D	APR'VD	DESCRIPTION

DRAWING NO.	3045C2	SHEET	2 OF 4